Organic Resource Manual

Funded by the United States Department of Agriculture
Sustainable Agriculture Research and Education (SARE)
Professional Development Program and the
Washington State Department of Agriculture
Organic Food Program

SARE PROJECT EW-96.006

An organic farm, properly speaking, is not one that uses certain methods and substances and avoids others; it is a farm whose structure is formed in imitation of the structure of a natural system; it has the integrity, the independence, and the benign dependence of an organism.

– Wendell Berry, The Gift of Good Land, 1981

Edited and Prepared by:
Nancy Taylor, former Organic Program Specialist, WSDA
Leslie Zenz, Sustainable Agriculture Coordinator, WSDA

Acknowledgements

Diane Dempster, Organic Produce Buyer - Charlie's Produce, Seattle, WA
Miles McEvoy, Program Manager - Organic Food Program, Washington State Department of Agriculture (WSDA,) Olympia, WA
Patrick Moore, Faculty- Sustainable Agriculture Program, The Evergreen State College, Olympia WA
Anne Schwartz, Owner - Blue Heron Farm, Rockport, WA and President - Washington Tilth Producers, WA

And special thanks given to the many others who gave editorial comments and direction to this resource manual.

This resource manual is also available at
Washington State University's Center For Sustaining Agriculture and Natural Resources' website at http://csanr.wsu.edu/
and
Washington State Department of Agriculture Organic Food Program's website at http://agr.wa.gov/fsah/organic/ofp.htm

We hope this manual will be a useful resource and we would like to hear your comments.
Please send comments to:
Washington State Department of Agriculture
Organic Food Program
P.O. Box 42560, Olympia, WA 98504
e-mail: organic@agr.wa.gov.

PUB 030 (N/11/99)

Organic Resource Manual

Table of Contents

Introduction

Every year the Washington State Department of Agriculture's Organic Food Program receives hundreds of requests for information on organic farming practices from individuals who would like to begin farming and from farmers who are interested in producing organic crops. Unfortunately, information on organic farming practices is scattered and not readily available. This lack of accessible information is a frustration shared by agricultural support agencies and farmers alike. In addressing this frustration, the idea for the Organic Resource Manual was developed.

This resource manual provides basic information concerning organic food production for farmers, university extension agents, Natural Resource Conservation Service personnel, and other agricultural professionals in the states of Idaho, Montana, Oregon, Utah, Washington, and Wyoming. The Organic Resource Manual contains a comparison of state and private certification standards for the production, processing and handling of organic products; general information on organic crop and livestock production including pest control and soil fertility management; and organic marketing trends and options for producers. In addition, the manual provides resources on agricultural organizations, support businesses, and publications on specific practices pertinent to organic and sustainable farming.

The compilation of this Organic Resource Manual was funded through a grant from the USDA Western Sustainable Agriculture Research and Education Program's Professional Development Program for agricultural professionals. The resource manual is not meant to be a "how to" guide but, rather, is intended to assist agriculture professionals by providing the basic information necessary to get started in an organic system and resources for more detailed information. The information provided in this manual focuses on the target states. When appropriate, however, we have included resources such as research bibliographies and organizations outside this region.

Sustainable and Organic Agriculture

In tracing the history of organic and sustainable agriculture, there are several milestones to mark the development of the movement. Which of these milestones would demarcate the beginning depends on the depth of one's perspective of agriculture. At the root, it would begin with the first time a farmer noticed a decline in the health and production capacity of a field and attributed it to the condition of the soil. Perhaps the origin of the recognition of agricultural sustainability was within Franklin King's book, *Farmers of Forty Centuries* (1911). This was the first indication in writing of a divide between agricultural practices that utilize low-input and ecological strategies, and those practices which depreciate soil fertility, resulting in a high degree of dependence on off-farm resources, or the need to find new ground. The coining of the phrase "organic farming" first appeared in the writing of Lord Northbourne in his book *Look to the Land*, published in 1940. In the period after WWII, US agriculture saw a tremendous rise in the use of synthetic pesticides and fertilizers. Innovations and buildup of infrastructure in the chemical industry during the war contributed to the effort to increase food production through chemical usage and mass-scale agricultural practices. Soon after, in the 1950s, the detrimental effects of synthetic chemical applications to agricultural lands began to emerge. In 1963, Rachel Carson wrote *Silent Spring,* which highlighted the decline of wildlife diversity and the increase in threats to human health as a result of these detrimental practices. This landmark book greatly accelerated the public's concern over the use of highly toxic pesticides on agricultural crops, giving new credence to organic food production and environmental awareness.

Today, it is clear that organic and sustainable agricultural practices will continue to gain recognition as highly productive, safe, and economically viable alternative approaches to growing food. This recognition is felt most in the marketplace with consumer demand for products that reflect ecological production practices. Often, the terms “sustainable” and “organic” are used interchangeably, but there are subtle differences between each type of agriculture that should be noted.

Sustainable Agriculture

“The most perplexing attribute of sustainable agriculture is that there is no precise, set formula that applies to all situations. Sustainable agriculture is applied uniquely to each site and is a management-intensive, resource-conserving process that considers both long- and short- term economics.” (Deborah Neher, 1992)

The USDA Sustainable Agriculture Research and Education (SARE) program defines **Sustainable Agriculture** as an integrated system of plant and animal production practices having a site specific application that will, over the long term:

- Satisfy human food and fiber needs;
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends;
- Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- Sustain the economic viability of farm operations; and
- Enhance the quality of life for farmers and society as a whole.

This definition describes, in broad terms, the goals of sustainable agriculture. However, the methodologies by which these goals are attained remains a contentious issue. There are production situations in which the minimal use of a synthetically derived pesticide or fertilizer may be the most viable solution. This action would be not be permissible in organic production standards, even if the persistence of the problem situation were to have a detrimental effect on the economic stability of the farm. Sustainable agricultural practices attempt to encompass the entire milieu of the farm with a systems-level approach. This includes attention and consideration of the economic systems in which the farm operates, as well as the handling of labor resources and production practices as they interact with the ecological network of the particular environment.

The current food system in the technologically developed world, including every step from seed to table, reflects past exploitative approaches to agriculture. Soils have become depleted, small farms cannot compete with integrated corporate producers in the market place, and consumers have come to expect a magical convenience; bought without consideration of the hidden costs of production. Appraising this situation with a sustainable approach creates a formidable challenge; one which lends itself to many interpretations of how sustainability will be reached.

Unlike the organic label, product labels that reflect sustainable practices, such as Natural, Pesticide-Free, and Free-range, among others, are currently unregulated and have no defined standards or mechanisms by which to verify compliance to a particular practice.

Organic Agriculture

The National Organic Standards Board (NOSB 1996) defines **Organic Agriculture** as:

> an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony. "Organic" is a labeling term that denotes products produced under the authority of the Organic Foods Production Act of 1990.

The philosophy behind organic agriculture embodies the same principles as sustainable agriculture. Organic production requires the use of materials and practices that maintain the balance of natural systems; striving to integrate the many components of the farming system into an ecological whole. Certified organic products are produced under specific standards and are subject to an annual inspection by the certification agency.

Organic food handlers and processors adhere to standards that maintain the integrity of organic agricultural products. Organic agricultural practices cannot ensure that products are completely free of residue. The standards attempt to minimize further contamination of air, soil and water. Organic certification agencies' standards require that producers and processors rely on natural processes and use naturally derived inputs. There are *very few exceptions* of synthetic inputs that are allowed for use in organic production. These exceptions are for products with very low environmental impact such as insecticidal soaps and insect pheromones. The simplest way to describe organic agriculture is: the production of crops without the use of synthetic pesticides or fertilizers. However, organic production, in its essence, is much more involved than simply focusing on prohibited and allowed inputs.

Regulating Organic Production

This section focuses on the regulations currently in place for organic food products. As the market for organic food has grown, so has the need for standards with which to define the terms and methods of organic production. Regulations and standards facilitate interstate and international trade. Standards also maintain the integrity of the organic industry. The term "organic" can mean different things to different people, therefore, regulations and standards were developed to assure adherence to basic criteria. There is a need for uniform national standards. Attempts to accomplish this are summarized in the National Organic Standards section.

For the purposes of this manual, the focus of discussion will be on organic certification agencies and state organic laws as they pertain to the states of Idaho, Montana, Oregon, Utah, Washington, and Wyoming. Minor variations in state laws and organic certification agencies' standards can affect a producers ability to sell organic products in certain markets. The following will assist you in understanding the similarities and variations that now exist between organic state laws, state certification agencies and private certification agencies. This discussion is meant to be a general overview. In all cases, the specific organization with which certification is sought must be contacted to get exact requirements. You may also refer to the *State Organic Laws-Quick Reference Table* (pg.49).

Current standards governing the production and processing of organic products are set by state laws and private organic certification agencies. There are presently three types of systems that regulate the production and marketing of organic products.

State Laws

In the US, 32 states currently have legislation that regulates the production and processing of organic food products. The rules and regulations for these laws vary from state to state. In the Northwest region, Washington, Oregon, Idaho (California, Colorado, New Mexico, Arizona, Nevada) have state laws. Only Utah and Wyoming do not. *(Please refer to the State Organic Laws Quick-Reference Table. For specific information contact the individual state agencies.)*

State Agencies

Of the targeted states that have organic laws, only Washington and Idaho operate organic certification programs through state agencies. These certification programs are housed within the state department of agriculture, which serve as both the government regulator and organic certification agency according to the states legislative rules. State certification agencies have the ability to enforce organic rules and impose penalties and fines for violations in the production, processing and marketing of organic food products. *(Please refer to the Organic Certification Agencies-Quick Reference Table on page 50. For more specific information contact the individual state agencies.)*

Private Agencies

Currently, there are 29 private organic certification agencies in the US. There are five primary agencies that serve the target states for this resource guide: Farm Verified Organic (FVO), Oregon Tilth Certified Organic (OTCO), Organic Crop Improvement Association (OCIA), Organic

Certification Association of Montana (OCAM) and Quality Assurance International (QAI). Each of these organizations have their own set of organic standards and require annual inspections of farms, processors, and handlers in order to be certified. Private certification agencies often will certify producers in states other than the one they are located in, including states that do not have organic laws. For example, OTCO, QAI, FVO, and OCIA will certify producers in Wyoming and Utah in order for these producers to sell their organic products to states requiring certification.

If a private agency is certifying a producer or company that is located within a state which has an organic law, then these agencies must assure that the producer or company being certified meets state requirements as well as the certifying agency's requirements.

Registration and Certification Requirements

Washington and Idaho state laws require annual certification for organic producers, processors, and handlers. In order to be certified, applicants must be inspected every year to verify they are following organic standards. Oregon law requires that producers, processors, and handlers that make organic claims are registered with the state. Certification is voluntary. Organic registration does not require annual inspection or application process. Montana requires only that products marketed as organic comply with a definition outlined in state laws and both registration and certification are voluntary. In states without state organic laws, such as Wyoming and Utah, producers are currently allowed to label their products as "organic" without being certified or adhering to any state law that defines organic production. Without certification status, however, marketing these products to states or foreign countries with organic laws can be difficult. Washington state requires that all products sold within the state that claim to be organic are certified as organic. This certification must be from an approved or 'recognized' organic certification agency, either state or private.

Annual Inspection

Organic certification requires annual inspections of the producer (processor/handler.) The purpose of the annual inspection is to verify that the required conditions are in place to meet the certifying agency's certification criteria or standards. Tools used by the inspector for verification include:

- A one on one discussion in person with the grower
- Reviewing records that the grower keeps: material receipts and application records, sales records, product labels, yield records
- Reviewing farm and pest management plans and sanitation practices
- Physically inspecting the crop and production sites, borders areas, equipment and storage areas for possible contamination problems such as commingling of conventional products or application of prohibited materials.
- Sample collection.
- Inspectors may return for an unannounced visit to the premises either as a follow up inspection or to collect commodity or product samples for residue testing.

Processing and Handling Requirements

Many organic certification agencies have standards for processors and handlers of organic products. Washington state defines a processor as anyone engaged in the canning, freezing, drying, dehydrating, cooking, pressing, powdering, packaging, baking, heating, mixing, grinding, churning, separating, extracting, cutting, fermenting, eviscerating, preserving, jarring, slaughtering, or otherwise processing organic products. Handlers are defined as anyone who sells, distributes, or packs organic products. Applications for processors and handlers are different than

those for producers. Producers that are also processors (creating value-added products) must apply for both types of certification. Standards for processing and handling of organic products cover all aspects from receiving the organic ingredients or products, processing, labeling and distribution of the finished product. A clear audit trail must be maintained which demonstrates that products being processed or handled are: 1) certified organic, 2) adequately separated from conventional products at the facility, 3) not exposed to contamination from post-harvest pesticides or other processing aids, 4) accurately labeled. Washington, Idaho, and Oregon state laws include rules for organic processing and handling. Washington and Idaho are the only states that require processors and handlers to be certified.

Certification Process

Each year certified producers/processors/handlers must apply for certification from either the state organic certification agency or a private organic certification agency. The certification process can take approximately 2-5 months from application to receipt of organic certificate. Here is how the process works for applicants:

1. Producers/processors/handlers contact an organic certification agency for certification program information and forms.
2. If producers want to be certified, they complete the application, production and land history forms and return it to the organic certification agency's office with application fees. Renewal applicants do not have to fill out history forms each year.
3. The organic certification agency will review the application and history information to see that it is complete and that it meets eligibility requirements for certification.
4. A letter from the organic certification agency is sent to the applicant that will either request more information or notify the applicant that an on-site inspection will be scheduled.
5. The organic certification agency's inspector will set up an inspection with the applicant.
6. Inspector fills out an inspection report that is submitted to the organic certification agency for review.
7. Applicants are notified by the organic certification agency of their certification status. For the sale of any certified product, a copy of the organic certificate must be provided by the producer/processor/handler that shows the commodities and/or products being certified and the date of expiration. Some organic certification agencies require that anytime a commodity is sold, the seller and buyer must request a "transaction certificate" that shows the transfer of ownership a specified amount of a commodity and that it is a certified commodity.

Fees and Assessments

Organic certification programs are funded by the party seeking certification much like grade certification programs for eggs or meat. This funding process is termed "user fees." Payment of application fees and inspection fees does not guarantee certification. Each certification agency has different methods for assessing fees for certification of organic products. In some cases, the inspection fee and an annual percentage assessment fee based gross sales of organic products are collected separately. In other cases, an annual percentage assessment fee is charged and the inspection costs are included. Often, new applicants will be charged an additional fee to cover the extra cost accrued in processing a new application.

Costs for an on-site inspection and product sampling for prohibited substances can be included in certification fees or are an additional cost depending on the organic certification agency. Usually application fees are paid up front prior to the inspection. Inspection fees, if charged separately, are due after inspection. Sales assessment fees are paid at years end. First time applicants usually

estimate gross sales for the first year. Contact individual organic certification agencies for more information on fee assessments.

Fines

Only state organic certification agencies by authority of state law can prosecute and levy fines for non-compliance of laws and standards. State fines for non-compliance range from $1,000-$25,000. Private organic certification agencies can revoke certification for non-compliance and work with state regulatory officials in cases of violations of state organic laws.

International Export

Most certified organic products can be exported as regulated by standard international trade rules. However, in order to facilitate exportation of organic products into the European Union (EU), an organic certification agency must have their program and standards reviewed and approved by a third party according to regulation EN 45011/ ISO guide 65. The USDA, acting as a third party, has developed a conformity and assessment program for all certification agencies in the US in order to meet the new EU regulation. Both state and private organic certification agencies need to be accredited to ISO 65 standards by the USDA in order to gain access to the EU.

There continues to be much work within all the international communities to "harmonize," or bring into consistency, organic standards in order for international trading of these products to become a more fluid process. Development of National Organic Standards for the US will greatly facilitate this process.

Comparison of Rules and Standards

The following will assist you in understanding the similarities and variations that now exist between organic state laws, state certification agencies and private certification agencies. This discussion is meant to be a general overview. In all cases, the specific organization with which certification is sought must be contacted to get the exact requirements. You may also refer to the *State Organic Laws-Quick Reference Table* (pg. 49).

Minimum Year Requirements for
Certified Organic and Transition to Organic

A transition period between conventional and organic agricultural production is required under all organic standards. This transitional period was originally set up to protect the integrity of organic markets, which could otherwise be flooded with product from farms that were not necessarily committed to fundamental change in their production practices. Most certifiers require organic animals to adhere to organic standards for the entire life of the animal. Most state laws and private organic certification agencies listed in the reference table require a minimum of a three-year transition period without the use of prohibited inputs, in order to label products as “certified organic.” Livestock is considered separately.

Several organic certification agencies’ standards allow for the certification and labeling of commodities as “transition-to-organic." The transition-to-organic crops can be labeled as such 12 months following the last application of prohibited materials. There are few marketing advantages associated with transitional products.

Acceptable and Prohibited Materials

Currently, many state and private organic certification agencies use established lists of approved, restricted and prohibited materials for use in organic production and processing/handling. The lists cover inputs such as fertilizers, herbicides, pesticides, seed treatments, and compost 'seed' materials. There are also limits or restrictions of raw manure application. The materials lists include generic compounds and, in some cases, brand name materials. The brand name lists exist not as endorsements for specific products but because the proprietary formulas used by different manufacturers can contain ingredients which are prohibited materials. Most organic certification agencies have both generic and brand names lists to limit potential confusion. The Washington State Department of Agriculture's Organic Food Program has developed one of the most extensive lists of approved brand name materials and have a materials review specialist on staff. Montana state law does not have a materials list included in their organic rules.

In general, approved materials are those that occur naturally. Prohibited materials are those that are synthetically manufactured. There are exceptions, approved on a case by case basis, where an alternative to a synthetic material is not available. Likewise, some natural materials are not allowed because of extreme toxicity (e.g., tobacco). Materials are evaluated based on several criteria. A partial list of criteria includes: effect on human health, effect on the farm ecosystem, toxicity and mode of action, persistence in the environment, availability of alternatives, probability of environmental contamination during manufacturing, use and disposal. Evaluation of materials is a continuous and dynamic process as new materials are developed or as more information about existing materials is made known.

The Organic Materials Review Institute (OMRI) is a non-profit organization started in 1997. Its mission is to publish and disseminate generic and brand name lists of materials that are approved for use in the production, processing, and handling of organic food. In a very short time, OMRI has become the central clearinghouse for determining which materials are allowed in organic food production. Many organic certification agencies utilize OMRI, in addition to review by advisory boards for their materials lists.

Organic producers must maintain records for all material inputs including: type of material, date of application, and quantity. Failure to adhere to the approved materials list of the certifying agency can result in a crop being decertified or not allowed to be marketed as organic. There are variations between the materials allowed and prohibited among the various certification agencies. Lists of materials and organic certification standards are very important and require utmost attention by the producer, processors and handlers of organic products. A material that was allowable on a list one year, may not be allowable the next year. Likewise, many supply catalogs sell products for organic production that are not allowed by some certification agencies.

Although considered an input, starts for row crop production are not on a list, but considered separately. Many standards require the use of organic starts in row crop production.
Contact individual organic certification agencies and obtain their materials lists for more specific information.

Pesticide Residues and Drift

The term "organic" is a production claim, not a residue-free claim. No producer farms in an isolated system and contamination of organic crops can occur. Most often contamination occurs due to spray drift; contamination with prohibited materials from applications on adjacent conventional farming operations. Pesticide residues can also be found in organic crops due to uptake by the plant of pesticides in the soil where residues from previously used, but now

prohibited materials remain in the environment. Other sources for potential contamination are: the inadequate rinsing of pesticide application equipment in combined organic/conventional operations, volatilization of surface pesticides from conventional products in storage, and contaminated belts, brushes or water in post-harvest handling, and fraudulent use of prohibited materials.

Most private organic certification agencies do not test for residues. Only the Washington State Department of Agriculture and Oregon Tilth test regularly for pesticide residues and have set limits for pesticide residue on organic food. The acceptable residue levels are set at 5% of Environmental Protection Agency (EPA) tolerance levels for pesticides in food and/or with Food and Drug Administration (FDA) action levels for pesticides that have lost their registrations (e.g. DDT, Aldrin, and Dieldrin). During the certification process, random samples are collected to verify compliance with organic production standards and to detect any problems with pesticide drift. Organic products found with positive results for pesticide residue may not be sold as organic if the residual levels exceed the set minimum.

Buffer Zones and Borders at Risk

Many organic certification agencies have established a 25-foot buffer zone requirement in efforts to distinguish organic crops from conventionally produced crops. This zone lies between organic and conventional production or, more generally, between organic crops and any prohibited material applications. Crops grown within 25 feet of conventional production cannot be certified organic. Likewise crops grown within 25 feet of any prohibited material application cannot be certified organic as in the case of herbicide applications along roadsides or irrigation ditches.

Borders at Risk are those areas where drift may occur due to airblast or aerial application of prohibited materials in adjoining areas. These areas are at a higher risk of contamination and therefore, are targeted for more rigorous sampling in certification programs that require sampling. Most certification programs require the identification of Borders at Risk. It is suggested, not required, that producers notify the party responsible for the property sharing the Border at Risk of the producer's organic status to avoid any potential problems with drift.

Soil Building and Fertility Maintenance Plans

The organic farming movement began, in part, as a way to address the deteriorating soil quality which led to increased erosion and decreased productivity. Maintaining and building organic matter in the soil is the cornerstone of organic farming practices. Organic production is more than the absence of prohibited materials: it is the practice of a management system that enhances the ecology of the place in which it exists. In order to address this principle, most organic certification agencies require a soil fertility management plan in order to certify crops and livestock pasture and forage systems. These plans often include practices such as crop rotation, use of cover crops and green manure, fallow rotations, soil testing, etc. Also required for the farm plan is a map detailing the production area. Specific soil building and fertility management techniques are discussed in greater detail in the *Organic Crop Production* section (pg.14).

Pest and Disease Management Plans

Organic production embraces the principle that pests and diseases, when they occur at accelerated levels, are a symptom of an imbalance within the production system. Certification agencies address this principle by requiring management plans for pest and disease control for crop and livestock production. These plans include strategies such as population monitoring, crop rotations, planting resistant varieties, etc.

Livestock Production Practices

Most certification agencies require management plans for pasture, pest control and general healthcare practices to be in place in order to certify livestock. Livestock standards cover slaughter, dairy, layer, and some apiary production systems.

There is great variability between certification agencies' standards for livestock production in terms of regulation of organic feed, drug and antibiotic use. However, no state or private standards allow for the routine use of parasiticides and antibiotics. Some vaccines are required by USDA animal health and welfare, and are allowed in organic livestock production. If a sick animal requires conventional treatment (which must be administered in order to save the animal's life), then it must either undergo a withdrawal period from organic production or be culled from the herd or flock depending on the agencies' standards. Management plans must include segregation options that prevent commingling of treated and non-organic animals with organic production stock.

Drug and antibiotic use is regulated differently for slaughter and laying animals than for dairy production. There are wide variations in allowable practices for the administration of drugs and antibiotics. For slaughter animals, some certifiers prohibit parasiticides entirely; for others the range is a 30-day to 12-month withdrawal period prior to slaughter. For laying hens, the prohibitions follow closely those of slaughtering chickens. For dairy production the withdrawal requirements, again, vary greatly between certifying agencies, ranging from 12 days to 12 months.

The majority of certifying agencies require a 100% organic feed for the life of the animal, with variations regarding emergency feed rations and supplement use. Feed requirements also vary based on the number of months prior to birthing, laying, slaughtering or milk production. (*For more specific information contact the individual certification organizations.)*

Record-keeping Requirements

Record keeping is an important aspect of organic farming and is required by most state laws and private certification organizations. Only Montana does not have record-keeping requirements. Producers must maintain records to facilitate tracing all production steps from land preparation, through planting and crop maintenance to the sale of finished organic product. Receipts for purchased materials are reviewed to verify that only allowed materials have been used. A journal of activities is used to verify soil fertility, pest and disease, and weed management plans are being followed. Harvest records verify yields and sales. Additionally, detailed records can provide a valuable history of how effective different inputs and management practices are from year to year, which aids the producer as well as the certifier. Records must be retained for 3-5 years and include some or all of the following:

- Materials application: type, source, quantity and the date applied to the land, crop or livestock
- Material or input receipts
- Crop acreage and location of crops and/or products produced
- Yield information
- Soil and petiole (plant) tests
- Water sources
- Receipts and sales of organic products.

Processors and handlers must also provide records for certification. These records may include purchases made from organic producers, complete lists of ingredients in products, sanitation plans and materials used, and sale receipts to verify gross sales, among others.

National Organic Standards

Currently, several different private and state agencies certify organic products. As illustrated in the previous section, the current standards for regulating organic production vary from state to state. Some differences are slight, some significant. The discussion would get more confusing if all 50 states were included and even more so if international standards are considered. To clarify the meaning of "organic" there has been a movement towards establishing national organic standards. With national organic standards, organic producers across the country would follow the same set of guidelines and meet universal standards. A brief discussion of this effort can be found in this section.

Organic Foods Production Act
Congress, in 1990, passed the Organic Foods Production Act (OFPA) as title XXI of the Farm Bill, setting into motion the process for developing national organic standards. This act was passed in order to:

- Establish national standards governing production and marketing of organic agricultural products;
- Assure consumers that organically produced foods meet a consistent standard;
- Facilitate interstate commerce in fresh and processed food that is organically produced.

The National Organic Standards Board
The National Organic Standards Board (NOSB) was appointed by the United States Department of Agriculture (USDA) in 1992. The NOSB was established to recommend standards for implementation of the OFPA and the National Organic Program. It is composed of the following industry representatives: organic producers, organic handlers/processors, retailers, consumer and public interest groups, environmentalists, and scientists.

USDA's National Organic Program
The National Organic Program (NOP) will require every producer of organic food to be certified. Certification would be renewed annually and require an annual inspection conducted by a USDA accredited certifier in order to use the word "organic" on the product label. The only exemption to this rule would be for producers with less than $5,000 in gross annual sales and who market their products direct to the consumer. The NOP will be administered by state and private certification organizations acting as agents of the federal government or by the USDA. It is expected that program costs will be covered by user fees paid by certifying agencies and certified entities. An example of a similar USDA program would be the grade certification for eggs or milk.

National Materials List
Organic certification requires regulating which materials can and cannot be used within the agricultural system for controlling pests, diseases and soil fertility. The National Materials List will include prohibited natural materials and approved synthetic materials. Synthetic materials not specifically approved will be prohibited. Natural materials not specifically prohibited will be allowed. These include both natural and minor synthetic production aids.

The National Organic Standards Board is responsible for recommending to the Secretary of Agriculture which materials will be on the list. In 1995, the NOSB completed a review of the materials currently in use by organic producers. For material reviews, a Technical Advisory Panel gathers and evaluates the scientific data and makes recommendations to the board based on seven review criteria:

- Effect on human health.
- Effect on the farm ecosystem.
- Toxicity and mode of action.
- Availability of gentler alternatives.
- Probability of environmental contamination during manufacture, use and disposal
- Potential for interactions with other materials used.
- Overall compatibility with a system of sustainable agriculture.

The list must be reviewed by technical reviewers in addition to the Environmental Protection Agency (EPA), Food and Drug Administration (FDA), and the USDA to insure that the materials do not conflict with current registration and regulation requirements. The Secretary of Agriculture makes the final determination.

National Organic Program--Proposed Rule

In August of 1994, after five years and fourteen public meetings held across the country, the board submitted its final recommendations for the National Organic Rules to the Secretary of Agriculture and the United States Department of Agriculture (USDA).

The USDA published its proposal for the National Organic Rules in December 1997. Unfortunately, while covering every aspect of organic certification, the rules proposed by the USDA varied greatly from the recommendations submitted by the NOSB. The proposed standards would have severely weakened existing organic standards. The proposal would have allowed many materials that are currently prohibited from use in organic farming such as the pesticide avermectin, toxins derived from genetically engineered bacteria, inert ingredients such as benzene, formaldehyde and xylene; and fertilizers such as cement kiln waste and biosolids (sewage sludge). In addition, the proposed standards would have allowed for the use of Genetically Modified Organisms (GMOs). If the proposed national standards had been adopted, consumer confidence would have been shaken and export markets would have been disrupted.

The USDA received over 280,000 comments, the most they have ever received on an issue open to public comment. Most of the comments were in opposition to the proposal. In July of 1998, USDA Secretary Dan Glickman stated that USDA will not adopt organic standards that are not supported by the organic food industry. It is our understanding that USDA will submit a revised proposal in 1999 for public comment.

Current Regulatory Framework

Thirty-two states have legislation pertaining to the labeling of organic food. In most states organic certification is voluntary. Under the USDA National Organic Program all growers, processors and handlers that make organic claims will be required to obtain certification. There are 44 organic certification agencies in the United States. Of these, 34 are private agencies and 10 are state-operated certification programs (MD, KY, CO, OK, LA, TX, NM, NV, ID, and WA).

Organic Crop Production

This section focuses on organic crop production considerations and presents the philosophical and historical basis that delineates organic from conventional production. General information on nutrient and pest management and approved materials is also covered in this section. References to pertinent research on specific organic systems and other resource information can be found in the *Resources Section* (pg. 51).

ORGANIC FARM PLAN

Most certified organic crop production standards specify that farmers adopt a written farm plan. According to NOSB recommendations, "A commitment to long-term soil improvement or maintenance at a high fertility level should be reflected in the Organic Farm Plan. The emphasis should be on building up organic matter in the soil through green manuring and/or applications of composted materials with complementary applications of rock materials." It should be noted that the benefits of a soil building program will accrue for the conventional as well as the organic grower. However, the differences in allowable materials and practices of conventional and organic necessitate that the maintenance and enhancement of soil organic matter levels be elevated to the highest priority for the organic grower.

Organic and conventional agriculture have an abundance of similarities despite the substantive differences. The day to day work flow and timing of seasonal operations on comparably sized farms may be identical. Tillage, cultivation, harvesting, spraying and processing equipment are bought and repaired at the same dealerships. Variables concerning weather, markets, prices, and labor management are identical, as are associated financial stresses. Indeed, the organic and conventional grower must possess the same levels of business and farming skills, personal endurance and love of the farming occupation in order to survive.

The differences between organic and conventional farming hinge primarily on allowable materials and associated practices. As noted above, a conventional grower may implement the soil organic matter enhancing practices resulting in reduced fertilizer and pest control inputs, yet still rely on an assortment of synthetically based pesticides and fertilizers to address production problems. A certified organic farmer's choice of fungicides, insecticides and soil amendments are limited to mostly naturally occurring substances to ameliorate production problems. Most permitted organic insecticides are contact insecticides with little residual effect and must be applied (and often re-applied) based on results of consistent crop monitoring. Allowable fungicides have little residual effect, are generally preventive, and are usually applied before evidence of infection occurs. In addition, many of the organically approved fertilizers and soil amendments aren't readily soluble, may be expensive to use on a large scale or are difficult to apply once crops are established. Once a fungal disease, pest outbreak or fertility deficiency symptom has taken hold in a field, it may take a number of applications of organically approved materials to control the problem. The added expense and possibility of a slower crop response may determine whether a crop will be profitable. Synthetic, highly soluble fertilizers and easy to apply pesticides can represent a significant production advantage for the conventional grower in terms of cost. Due to the limited materials acceptable for organic crop production, organic farmers must rely primarily on precautionary strategies and create biological systems to avert nutrient deficiencies and pest and disease problems.

Emphasis on maintaining or increasing soil organic matter represents the primary, precautionary strategy used by organic growers. Benefits of adequate soil organic matter include:

1. Improved drainage and moisture holding capacity (Brady 113, 132, 135, 423);
2. Improved aeration and root penetration (Brady 113, 132, 135, 423);
3. Reduced inputs of fertilizers (Parnes 9; Lampkin 54; Coleman 95, 98);
4. Improved crop resistance to pests and diseases (USDA 334; Culliney & Pimental, 253-266);
5. Some weed suppression effects;
6. Increased resistance to soil erosion;
7. Increased populations of soil micro-organisms which allow for:
    - Improved availability of nitrogen and mineral nutrients;
    - Enhanced nutrient exchange in the plant rhizosphere;
    - Further improvement in soil structure;
    - Some soil pathogen resistance; and
    - Improved distribution of nutrients in the soil (Parnes 10; Brady 113, 132, 135, 423; Werner & Dindal 24-32; Lampkin 27).

In addition to these benefits that are attained through soil organic matter enhancement, organic farming requires a system of crop rotation and specific crop management techniques relative to each cultivar and crop type. When all of the above techniques are executed properly "each practice aids another, and the result is synergistic" (Coleman 95). This synergy results in a cropping system that manifests few nutrient deficiencies and minimal pest or disease problems.

NUTRIENT MANAGEMENT

Use of animal manures, compost, cover crops, green manures, and organically approved soil amendments are the cornerstones of organic nutrient management as well as key components of a soil organic matter enhancement program. It should also be noted that, organic certification agencies restrict the application of raw manures on annual edible crops to no less than 60 days prior to harvest.

Animal Manures

The use of animal manures completes the nutrient cycle allowing for a return of energy and fertilizer nutrients to the soil. At present, manure from livestock feedlots, poultry operations and many dairies is considered a pollution and waste disposal problem. By using the waste products from other areas of agriculture organic farming techniques can build soil organic matter, provide nutrients for crop growth, reduce or eliminate chemical fertilizer inputs and address a growing environmental problem.

The extent of the benefits realized through the use of animal manures are dependent on many variables. This variability stems from the fact that few farms produce sufficient animal manure to support intensive crop production (with the exception of dairies). Therefore, most growers have little control over the source and type of animal manure and must use what is readily available. Proximity to fertilizer materials is a recurring problem for organic growers. Factors affecting nutrient content include:

1. Type of manure;
2. Moisture;
3. Bedding content;
4. Degree of freshness;
5. Method of storage at time of production; on-farm storage; and
6. Method and timing of application.

- The variability of manure sources necessitates an evaluation of the above factors on a case-by-case basis to determine appropriate application rates. Consult local agricultural extension offices for more detailed information on determining appropriate manure application rates.

The following are general considerations relative to the use of animal manures:

1. Reduce nutrient losses in manures by using fresh manure. Up to 37 percent of nitrogen may be lost due to leaching of nitrate or volatilization of ammonia during storage.
2. Reduce losses during storage by covering manure with plastic sheeting or store under a shed roof.
3. Reduce leaching into environment by locating piles away from surface water, preferably on concrete with allowances for drainage and storage of leachate.
4. There is evidence that composted manure, relative to fresh manure, increases crop yield and decreases the number of viable weed seeds (Lampkin 95).
5. E-coli and other bacteria problems are associated with the use of raw animal manures as opposed to composted manures.
6. Apply manure in late winter or early spring, six weeks prior to planting a crop. This allows for minimal nutrient loss via leaching and maximum crop uptake.
7. There are specific equipment demands relative to the use of manure. At a minimum, a manure spreader, capable of breaking up clumps to allow for even spreading, and front-end loader equipped tractor are necessary. Sizing and types of equipment are intimately linked to acreage being farmed.

Compost

The use of compost in commercial organic agriculture is promising. Factors that have limited wide-scale use of compost are: locating appropriate materials; cost of transporting feedstocks and finished product; production factors; permitting requirements for larger operations; and cost of specialized equipment. Nonetheless, the increased costs of solid waste disposal at landfills, increased regulations for on-farm manure management, and increased difficulty in obtaining quality manure sources are combining to make composting a cost effective and even profitable enterprise.

1. Compost contains antibiotics and antagonists to soil pests allowing for increased plant resistance to attack (Lampkin 95).
2. Studies have shown increased crop yields using compost when compared with the use of fresh manures and chemical fertilizers (Lampkin 95).
3. Studies indicate increased weed control and crop disease resistance benefits. Heat generation during composting process destroys weed seeds and many disease pathogens (Coleman 95).
4. Soil biological activity is increased by the use of compost allowing for long-term, steady release of available plant nutrients (Koepf 30).
5. Direct applications of compost come into equilibrium with the soil ecosystem very rapidly. The temporary nitrogen (N) depletion resulting from additions of raw manure or green manure does not exist when applying compost (Lampkin 94).
6. Compost builds soil organic matter rapidly thereby enhancing the benefits of soil organic matter listed above.
7. Compost encourages root growth as opposed to raw manure which may limit root growth (Lampkin 358).
8. Nitrogen fixing bacteria populations in soils may be enhanced (Lampkin 155).
9. The nutrient availability of organic mineral amendments such as rock phosphate are increased when added to compost piles at the beginning of the composting process.
10. Composting reduces the bulk of feedstock materials resulting in cost saving related to spreading and storage of material.
11. In general, an annual application rate of 5 to 10 tons per acre is recommended for intensive annual cropping and 5 to 7 tons per acre for perennial pastures and hay fields. Always refer to soil tests and compost analysis for determination of site appropriate application rates.

Green Manures and Cover Crops

The use of green manures and cover cropping is a standard practice in the organic farming industry. Considerable research has been done on the benefits of these practices. When considering the costs and limitations on animal manures and/or compost as fertility sources, the benefits of using green manures more than offset the costs.

Potential Benefits of Green Manures

- Nitrogen accumulation and maintenance
- Organic matter accumulation and maintenance
- Reduction of nutrient leaching (N, Ca, K)
- Reduction of soil erosion
- Improved utilization of rainfall
- Shading of soil
- Aeration of soil
- Even out spatial variability of nitrogen
- Weed and Pest Control
- Nutrient cycling between soil horizons
- Increased soil microbial activity
- Providing cost saving as a result of:
  - Lower fertilizer use,
  - Improved nutrient utilization,
  - Easier cultivation, and
  - Reduced plant protection needs.

Selection of green manure crop varieties and aspects of management are dependent upon the intended function of the crop. Regardless of function, the core concept that applies to soil building rotations is that all the benefits listed will be maximized to the extent that the ground is consistently occupied by live plants. There are ample references listed in the appendix that provide information on developing rotations that adhere to this core concept while allowing for profitable farm operation. Basic concepts and considerations are covered below.

Functions of Green Manures

The five main functions of a green manure are:

- Winter cover crop
- Summer green manure crop
- Catch crop
- Forage crop
- Intercropped/undersown crop

A winter cover crop is typically planted after the fall crop harvest. If uptake and storage of nutrients (typically N) is desired, a non-legume crop (commonly winter rye) is selected. If fixation of nitrogen is the objective, a legume is chosen. Often a mixture of legumes and grass will be used. Summer green manure crops are typically grown in lieu of a cash crop. The purpose is to provide organic matter, uptake and store soil nutrients, compete with weed seeds, and to protect and improve soil tilth. Non-legumes such as buckwheat, oats and winter rye fulfill these roles. However, if nitrogen fixation is desired, Austrian pea, vetch, fava beans or any number of other legumes may be used or mixed with a grass. Catch crops, "catch" soil nutrients which are returned to the soil when they are tilled in. Catch crops are typically sown after the harvest of late spring/early summer crops providing the same functions as summer green manures. A forage crop is used as feed or pasture for livestock and is usually allowed to form a sod over a number of years. A mix of pasture grasses and legumes provides excellent root penetration and fixation of nitrogen over time. Prior to plow down the forage crop should not be grazed or harvested to allow for maximum additions of organic matter and optimum nitrogen fixation.

A significant drawback in using green manures and cover crops is they may occupy land in lieu of a cash crop. Oftentimes a grower may not be able to afford this short-term reduction in income. Adding to the hardship of reduced income are the costs associated with managing the cover crop

itself. Costs include seed, maintenance, field work and irrigation. In response to these costs many growers have been using green manure crops as an intercropped or undersown cover crop.

Undersown or intercropped cover crops allow the accrual of the benefits while a cash crop is being grown. Generally a legume cover crop is selected to provide the nitrogen requirements for the cash crop. However, a winter hardy non-legume is often selected and sown under late maturing crops allowing for continuous ground cover through the winter.

Use and Selection of Green Manure Crops

1. Timing of seeding is relative to goals. For example, a winter cover crop of rye grain must be well established before the onset of winter. Three to five inches of growth should be achieved before light and temperatures slow plant growth.
2. Select an appropriate green manure adapted to the growing environment. Alfalfa, for example is a poor choice west of the Cascade range in northern Washington.
3. Timing of incorporation into soil. A low carbon to nitrogen (C:N) ratio stimulates a release of available nutrients, and a high C:N ratio builds organic matter and may tie up nutrients in the short-term, therefore, it is wise to incorporate a green manure at least a couple of weeks prior to planting the cash crop to allow for a reduction in C:N. Likewise, a lower C:N ratio is achieved when green manures are incorporated while they are green and leafy relative to incorporation after they have become dry and woody.
4. Effects on beneficial and pest organisms are variable. For example, pest such as bean and pea aphids may be present in clover, alfalfa, vetch and field peas, while over eighteen species of beneficial predatory wasps may be found in sweet clover, buckwheat and cowpea cover crops (Bugg). More study needs to be done in this area.
5. Availability and cost of seed: Winter rye seed typically runs less than $15 per acre at 75 pounds per acre and is widely available. Buckwheat seed may cost $30-$40 per acre and is more difficult to locate.

Considerations for Undersowing

1. Undersown cover crops must be sown before the cash crop shades it out and yet not so early that the cover crop competes with the cash crop for light.
2. The selected species and variety must be shade tolerant. White clover, hairy vetch, crimson clover and winter rye have proven to be successful undersown cover crops
3. The growth habit of the undersown crop must be compatible with the growth habit of the crop. For example, biennial black medic is being used as a self seeding undersown cover crop in rotation with spring peas and wheat. The prostrate growth habit of the medic provides little competition with the wheat and peas (Goldstein et al 51-56).
4. For weed control considerations rapid growth and germination are a must. White clover, sub clover, and rye grass are good choices.
5. Winter hardiness. Colder inland regions may have difficulty finding varieties that will survive extreme cold. The following have shown good cold tolerance: Ladino clover; Rose clover; Austrian pea; Hairy vetch; Winter rye - the best choice for extremely cold regions (CA State Water Resources Control Board 10, 26, 55, 61, 151).
6. Take into consideration the field requirements for next season's crop. For example, a mature stand of winter rye may make early spring soil preparations difficult. Conversely, a frost killed stand of buckwheat or spring oats may prove adequate to protect the soil through the winter and allow for early spring soil preparation.
7. The undersown crop must be able to withstand foot traffic. White clover and vetch are excellent choices for example in orchards (Coleman 76).
8. Care must be taken to insure cover crop is not a host for pests of subsequent crops.

PEST MANAGEMENT

Conventional wisdom within the organic farming industry contends that a healthy growing environment will produce plants resistant to insect and disease attack. Coleman asserts that pesticides are superfluous and well grown plants are not susceptible to pests (173). Lampkin suggests that the role of pest and disease organisms is to attack weak points within the ecosystem to make way for better adapted species (217). Furthermore, Lampkin states that the presence of pest and disease organisms in the field is a symptom of ecosystem instability within the farm (217). Stability may be achieved when pest and disease organisms remain in balance with dominant flora and fauna. The goal of organic and sustainable farming is to move the farm environment towards this state of balance. Koepf captures the essence of this endeavor stating that the principles of an integrated pest control program hinge upon the maintenance of diversity within the overall environment. He likens the well managed farm to an organism that possesses inherent stabilizing factors (117). There are no formulaic spray programs or wonder materials that will confer the inherent natural stability Koepf refers to, which allows for some pest pressure. At the same time, healthy soils and growing environments will not eliminate all pest and disease problems but will improve the overall quality and yields of the crops produced.

Farm ecosystem stability may be improved by implementing the following practices: enhancing and maintaining soil organic matter levels; using animal manures and composts (if available) as fertilizers; enacting a green manure and cover cropping component within a proper crop rotation sequence and implementing the practice of undersowing cash crops when practical. Essential to success is developing the capacity to adapt the above practices to the specific farm-site**.**

Non-chemical Crop Husbandry Practices *(Lampkin 230)*

Create Optimal Site Conditions *(soil, climate, environment)*	
• Cultivation • Organic manuring and crop nutrition • Stalk and residue destruction • Soil moisture and irrigation ***Diversity Over Time*** Discontinuity of monocultures • Crop rotations • Use early-maturing varieties • Use crop free or preferred host-free periods • Manipulation of sowing and harvesting dates ***Biological Control*** • Augmentation or importation of beneficial insects & pathogens	***Diversity in space*** • Variety mixtures • Resistant cultivars • Crop mixtures • Strip/inter cropping (companion planting) • Mixed cropping • Undersowing • Maintaining a soil cover • Management of wild plants (weeds) in and around crops ***Altering pest behavior*** • Use of trap crops • Use of green manures • Size, planting density and shape of crop • Pheromones

Crop Rotation

The importance of crop rotation in organic farming systems cannot be overstated. Crop rotation creates the diversity in space and time that interrupts the growth and development of weed, pest and disease populations. Lampkin refers to "soil sickness" as a poorly understood phenomenon where growth and development of a crop is hindered by an increasing incidence of nutrient deficiencies and pest and disease infestations (128). The conventional approach to soil sickness

has resulted in increased use of fertilizers and pesticides. With a choice of limited materials, organic growers must use crop rotations as the primary precautionary measure to reduce and prevent the soil-sickness syndrome.

While fertility enhancement and pest and disease management are the main benefits of crop rotation, a crop rotation plan must also allow for the profitable operation of the farm business. Reconciling the economic necessity of maximizing production and maintaining sustainable, well designed rotations is a challenge that virtually every organic farmer addresses on an annual basis. The work of developing rotations has been relatively unsupported by university research and is a primary research need within the organic farming industry, especially in the area of dryland grain production and green manure or cover crop rotational options.

One benefit of crop rotations is the break in pest and disease cycles that occurs when you rotate from a grain crop to a legume crop for example. Every crop and production system has specific pest, disease and fertility problems that are relative to specific sites. Francis et al state " The greater the differences between crops in a rotation sequence, the better cultural control of pests can be expected (114). Despite the specificity of individual farming sites and cropping systems, research conducted consistently shows a relationship between soil building crop rotation and increased soil organic matter levels (Hainsworth 133-135; Lampkin 148) The higher levels of soil organic matter are largely responsible for the overall benefits of crop rotation.

Benefits of Crop Rotation

1. Reduced soil erosion:
   a) Reganold reports soil erosion rates of 16 megagrams per hectare (8.5 Ton/Acre) for corn following corn and only 5.4 megagrams per hectare (2.9 Ton/Acre) for corn following 2 years of grass/clover hay.
   b) Reganold also sites a 1944 study by Horner et al. concluding that the higher the organic matter, the lower the soil (144-155).
2. Higher crop yields:
   a) Koepf reports 25% higher wheat yields in winter wheat sown after a clover or beet crop when compared to continuous cereal crops (39).
   b) Yields of grains following legumes are often 10-20 percent higher than continuous grain regardless of fertilizer applied (National Research Council 139).
   c) Rotations without a leguminous phase also enhance yields. Corn after wheat produces greater yields than continuous corn (National Research Council 140).
3. Increased soil microbial biomass:
   a) Fraser et al, found higher levels of microbial biomass, CO2 evolution, and bacterial and fungal counts in rotated plots (585-590).
4. Increased soil nitrogen:
   a) associated with higher levels of microbial activity.
   b) Use nitrogen fixing crops (peas, beans, alfalfa) in proper sequence to nitrogen demanding crops (corn, cauliflower and grains).
5. Increased drainage and moisture holding capacity and reduced soil compaction (Francis et al 113; Coleman 53-55).
   a) High root biomass and low root biomass allow for maintenance of soil structure. For example, carrots tend to compact soil while grass crops tend to loosen and enhance soil structure.
6. Weed control:

a) Alternate planting times relative to dominant weed species present. Velvet leaf is a major weed species in corn growing areas. Its habit of germinating late in the growing season, after the final cultivation makes control difficult if corn is grown continuously. Alternating corn with crops that are planted in mid to late summer or have produced a full canopy of leaves at the time of velvet leaf germination interrupts the growth habit of the velvet leaf.
b) Some crops naturally suppress weeds while others are very susceptible. Many vegetable crops are easily cultivated and kept weed-free while other crops, grain crops for example, are more problematic. Crops with wider spacing requirements such as corn are more weed tolerant than tightly spaced, slower germinating crops such as carrots and beets. Rotate weed suppressive crops (e.g. squash) with weed susceptible crops.

7. Allowance for intensive green manuring and the associated benefits mentioned above.
8. Pest and disease control:
   a) Allow sufficient time intervals between plantings of disease or pest prone crops and crop relatives. To avoid a number of fungal diseases, alliums should be planted no more than once every 3-5 years. This imposes strict limitations on plantable acreage. For example, a 100-acre farm may plant only 20 acres of potatoes or garlic per year to sustain a 5-year rotation. The cropping diversity required under this regimen is a challenge from a production and marketing standpoint. Likewise, grain rotations with green manure and cash-crop legume components present similar challenges.
   b) Avoid disease or pest host crops within the rotation. The use of mustard as a green manure in rotation with brassica crop production is a poor choice in that it provides an interim host for various disease and insect pests. Likewise, leguminous green manure crops (vetch and clovers) may harbor pests of subsequent legume cash crops.

Once the fundamental stability of the farm is achieved through proper crop rotations and a soil building program, localized pest and disease problems may still be unavoidable. These problems are dealt with through mechanical, cultural and biological methods and then as a last resort the use of organically approved pest control materials and products. While a comprehensive discussion of methods and materials is beyond the scope of this publication a brief overview of pest management techniques and materials follows.

WEED MANAGEMENT

Weeds are considered the primary pest in most organic farming systems. Since there are no practical, affordable herbicides on the market for organic production, organic farmers rely primarily on mechanical and cultural practices to control weeds. Many of these practices are routinely performed by conventional growers, but generally in terms of soil preparation and as an augmentation to weed control with herbicides.

In organic farming, mechanical and cultural techniques are geared towards reducing and maintaining a reduction of weed propagates in the soil. The ideal for all organic growers is to never let a weed go to seed and to restrict the dispersal and growth of perennial weeds.

To achieve this ideal, the following criteria must be fulfilled:

1. The grower must have access to properly scaled and appropriate equipment that will facilitate timely operations relative to weed species seasonal development in the field.
2. Sufficient monitoring and record keeping of field conditions must be performed to enable the farmer to anticipate required weed control actions.
3. Adequate knowledge of weed biology is essential to make correct and timely weed control decisions.

Mechanical Weed Control

Mechanical weed control is achieved primarily through tillage and cultivation. Tillage is the working of the soil before planting of a cash crop and after crop harvest. Primary tillage is usually a deep tillage designed to bury crop residue or cover crops in preparation for planting of a cash crop. Primary tillage is typically not considered to be a significant weapon in the weed control arsenal. A deep tillage will bury weed seeds to a sufficient depth they are not an immediate problem. However, deeply buried weed seeds will resurface slowly over a period of years to continually re-infest a field.

Secondary tillage is typically performed after primary tillage and geared towards weed control or the creation of a seed-bed for a cash crop. Rotovators, roterras, discs, spring-tooth harrows and rotary hoes are secondary tillage tools that usually work the top four or five inches of soil. Weed seeds aren't buried deeply and with each pass are exposed to light and subject to germination. Repeated passes with secondary tillage tools will reduce the soil seed bank of annual weeds by allowing weed seeds to germinate and destroying the seedlings with subsequent passes. Repeated tillage is an extremely effective method of organic weed control. A reduction in the seed bank before planting of the cash crop assures lower weed seed germination while the cash crop occupies the ground. A heavily infested field may be taken out of production for a season and tilled repeatedly, perhaps with the use of irrigation to ensure weed seed germination.

Cultivation is performed once the cash crop is planted. Crops that take time to germinate and are planted deeply i.e. corn and peas, may be blind cultivated between row and in row before emergence. Once the crop emerges the number of cultivations performed is usually relative to the weed pressure and limited by growth of the crop. If the soil seed bank is at a low level weed pressure will likely be low. One should also consider that increased tillage for weed control can increase soil erosion, which is diametrically opposed to the goal of increasing soil organic matter.

Thermal weed control, also known as "flaming," is another type of mechanical control worthy of mention. Substantial reductions in weed control costs can be realized in the following crops: carrots, beets, corn, onions and grains. Thermal weed control dehydrates weed plant tissue by exposing the plant to 100 degree Celsius temperatures for 10 seconds or more. Thermal control may be used as a pre-emergent, post emergent, or pre-harvest weed control measure.

Pre-emergent thermal weeding is used on carrots and beets as follows: The soil is prepared for planting. After 10-14 days, the carrots or beets are planted into newly emerging weed shoots. Six to eight days later, depending on weather conditions, the field is flamed thereby killing weed seedlings and allow the crop to emerge into a clean field. Subsequent withholding of cultivation is necessary to avoid exposing weed seeds to light and allowing germination. If done correctly, thermal weed control may save $300-$500 per acre. One caveat to pre-emergent flame weeding is that if conditions in the field aren't suitable to the flaming operation and the cash crop germinates into a weedy condition the crop may be lost. For flame weeding to work as designed, weed seedlings should be dry. Flame weeding on a rainy day may not work.

Post-emergent flame weeding is used to control weeds in the row between crops with the use of shields, and for in-row weed control in newly emerged onions, grains and corn crops. Lampkin recommends two flame applications on corn and grains at the "match" stage (2-3 cm) and at 25 cm. Onions may be treated three times at 5, 20 and 40 cm (201). Pre-harvest weed control is used to defoliate potatoes and to kill weeds left in the field.

Cultural Weed Control

Cultural weed control refers to any method or practice, excluding mechanical and biological, which imparts a control on the competitive nature of weeds. Some of the more widely practiced cultural weed control methods are listed below:

1. Appropriate crop rotation designed relative to weed species present.
2. Using compost if available.

3. Adjusting seeding dates of cash crop. For example, in fields infested with field mustard considerable weed pressure could be expected in early spring. Delaying the planting of a cash crop would reduce weed pressure.
4. Use transplants when possible to give the cash crop a competitive advantage.
5. Plant crop varieties that are tolerant to weeds. Callaway lists varieties of beans, rice, wheat, alfalfa, soybean, carrot, potato and squash that are tolerant to the presence of weeds. Characteristics that impart tolerance are: rate of seedling establishment, speed of development and density of canopy, crop vigor and productivity and how the crop uses nutrients (169-180).
6. Plant undersown cover crops and green manure crops to keep the ground occupied at all times. Alleopathic cover crops suppress weeds by releasing growth inhibiting hormones into the soil. Winter rye, buckwheat, mustard, crimson clover, hairy vetch and subterranean clover have shown alleopathic properties (Regnier & Janke 183).
7. Restrict dispersal of weed propagates. Weed seeds and reproductive parts are routinely transported on farm machinery, tools, vehicles, livestock and clothing.
8. Select manure sources carefully. Weed seeds contained in livestock feeds will infest farm fields. Grass fed livestock manure is renowned for high weed seed content. Grain fed poultry poses considerably less risk.

Weed Control in Perennial Crops

Weed control in perennial cropping systems is a significant challenge to the organic grower. Perennial crops do not allow for the weed control benefits of crop rotation, cover cropping, variety selection and many of the other cultural practices. Once the perennial crop is planted the weed condition of the field will remain fairly constant throughout the life of the planting. Therefore it is of paramount importance to effectively reduce the weed seed bank and eliminate all perennial weeds before planting perennial crops.

The following are considerations for effective weed control in perennial crops:

1. The chosen spacing of the crop is extremely important as sufficient room for the passage of cultivating equipment must be assured for the lifetime of the crop.
2. When considering tree fruit training methods, density of plantings and irrigation systems will dictate the ease of orchard floor management.
   - Allow space under the tree for passage of weed control devices.
   - Consider a medium density of 500 trees or less per acre to allow for easier weed control under the trees.
3. Cover crops may also provide excellent weed control, such as alfalfa in orchard floors.
4. Perennial herbs, strawberries and flowers are particularly problematic.
   - Leave sufficient space for cultivation in-row and between row.
   - Matted row plantings of strawberries are impractical to keep weed free. Reduced densities, hence yields, are a necessary aspect of organic strawberry production.
   - Consider the use of plastic mulch material for strawberries, herbs and flowers.
   - Allow time for repeated hand weeding of perennials.
   - Some growers periodically transplant entire fields of perennials to clean fields due to weed infestations.
5. Weeder geese are extremely effective at weeding out grass in cash crop. Many growers use geese on strawberries, raspberries, potatoes and garlic. They may also be used on tree crops and perennial herbs. Primary consideration must be given to whether or not the crop is able to withstand some trampling by the geese. Also, geese require a commitment on the part of the grower to actively manage their weeding activities.

INSECT AND DISEASE PEST MANAGEMENT

When insect pest outbreaks occur, organic growers have three control strategies to choose from: mechanical, biological control, and organically approved insecticide materials. All of these methods should be considered as last resorts. If little or no effort is made to create an ecologically diverse farm environment, economically damaging pest infestations will be a recurring phenomenon.

Mechanical Insect Control Methods

1. Bug vacuums physically remove insect pests. They are non-selective and may remove beneficial insects as well. Bug vacuums are extremely effective when used in combination with a trap crop. For example flea beetles vacuumed off an early radish trap crop reduces flea beetle populations for following brassica crops.
2. The use of floating row covers excludes flying insects. Floating row covers are affordable and available in large enough sizes to allow use on large acreage.
3. In some cases hand removal of insect pests may be the most affordable option. If done in a timely fashion insect pest populations may be held in check.
4. Sticky traps in combination with insect attractants are sometimes effective.
5. Mating disruption for Codling Moth and Oriental Fruit Moth has proven to be an effective method of control. The profusion of female moth pheromones confuses the males and prevents mating. Placement of up to 400 pheromone impregnated twist ties throughout an orchard is necessary. Cost of treatment ranges from $44 to $110 per acre/year (Unterschutz, personal).

Biological Insect Control Methods

Biological insect control is an essential component of an organic pest control strategy. Biological control uses insect pest predators, parasites or pathogens to control insect pest infestations. Organic growers may augment beneficial insect populations present in the field, import entire populations or enhance plant diversity in the field and along field edges to provide habitat for beneficial insects. Alternatively, a microbial control such as *Bacillus thuringiensis (Bt)* may be appropriate to use alone or in combination with pest predators. The most common biological insect control methods are:

1. Lacewing: *Chrypsoperla carnea*, *C. comanche*, and *C. rufilabris* larvae prey on a wide assortment of soft-bodied insects, eggs, and mites in field crops, vineyards, and tree crops respectively.
2. The chalcid wasp is very effective at controlling whitefly infestations in greenhouse environments. Likewise the red spider mite is kept in check by a small predatory mite--*Phytoseiulus persimilis* (Lampkin 249).
3. About 250 insect species encompassing 10 orders have been found susceptible to *Steinernema feltiae*, an entomogeneous nematode (Luna & House 163).
4. The parasitic trichogramma wasp attacks the eggs of *lepidoptera, homoptera, hemiptera and orthoptera* insect orders (W. Olkowski & Daar, H. Olkowski 75).
5. *Trichogramma pretiosum* and *T. platneri* are effective *lepidopteran* egg parasites in field crops and tree crops respectively.
6. Bacillus thuringiensis (Bt) bacteria has proven to be extremely effective when used against *lepidopterans* in the larval stage and other insect pests.
    - Must be eaten by the insect to be effective.
    - Over 35 species of Bt have been identified and are effective against different groups of insects (W. Olkowski & Daar, H. Olkowski 132).
    - The most widely used variety is *kurstaki,* used against *lepidopteran* larvae. The variety *tenebrionis* is effective against the Colorado potato beetle.

Many beneficial insect predators and parasites feed on pollen and nectar in adult stages. Food attractants are available for purchase that will attract these adults. Alternatively, planting nectar producing plants will provide habitat and a food source for beneficial insects. Plants from the *Umbelliferae* family, such as wild carrot and dill, are an excellent choice. In the event of an actual or anticipated pest infestation, the natural populations of beneficial insects may be augmented with purchased beneficials. There are numerous companies that specialize in rearing beneficial insects for commercial growers. (See *Agricultural Support Businesses,*. Resource Section, pg.RS-5.)

Insecticide and Disease Control Materials for Organic Production

Broad spectrum botanical insecticides affect a wide array of insects pests, while the narrow spectrum horticultural oils and dusts and insecticidal soaps are somewhat more selective and of lower toxicity. Organically approved fungicidal materials are preventive and usually applied before disease problems are manifested in the field. All of these materials are used only when the non-chemical crop husbandry practices have proven ineffective and pest damage is reaching economically damaging levels. Please contact organic certification agencies for a list of approved materials before applying any insecticide.

Most commonly used *broad spectrum* botanical insecticides:

1. Pyrethrum:
    - Disrupts transmission of nerve impulses causing paralysis.
    - Causes quick knockdown, however some species are able to detoxify pyrethrums. Therefore a synergist is often used in the formulations of this insecticide. Currently piperonyl butoxide (PBO) is used as a synergist in some pyrethrum formulations. PBO is allowed under organic regulations in some states and not in others (most notably California).
    - Some formulations of pyrethrum insecticides are PBO free.
    - Used against a wide array of insects including: ants, caterpillars, beetles, leafhoppers, and flies.
    - Pyrethrum breaks down rapidly in sunlight. Late in the day applications are recommended.
2. Ryania:
    - Derived from the wood of *Ryania speciosa*, a small shrub-like tree.
    - Excellent organic control of codling moth when immediate control is necessary.
    - Ryania is more effective when used with an organically approved sticker-spreader.
3. Sabadilla:
    - Ground up seeds of the sabadilla plant.
    - Effective against Squash bug, Lygus bug, caterpillars, Leafhoppers and Harlequin bugs.
4. Neem:
    - Oil extracted from the seeds of the tropical neem tree.
    - Neem has fungicidal, insecticidal and bactericidal properties and is effective against a wide array of insect pests.
    - Registered for use against codling moth, aphids, leafhoppers, root maggots and pear psylla.
    - Neem is a relatively new product in the U.S. and there is much to be learned regarding appropriate usage of this product.
    - Research suggests that neem inhibits feeding and growth of up to 170 insect species in seven orders of insects (W. Olkowski & Daar, H. Olkowski 115).

Most commonly used *narrow spectrum* insecticides:

1. Insecticidal Soaps:

- Made from selected fatty-acid chains, insecticidal soap penetrates the insect's outer covering and disrupts the integrity of nearby cells causing paralysis and dehydration (W. Olkowski and Daar, H. Olkowski 115).
- Susceptible insects are soft-bodied insects including: soil organic matter mite species, aphids, scale, whiteflies, pear psylla, sawflies, and thrips.
- Multiple applications of insecticidal soaps are usually necessary for complete control.
- Soaps are toxic to soil organic matter plants. Check on limited leaf surface prior to application.

2. Horticultural Oils are allowed under organic rules and used on fruit trees to smother soft-bodied insects, overwintering insect eggs and codling moth control during the growing season.
3. Diatomaceous Earth:
   - Ground-up remains of fossilized diatoms.
   - Absorbs waxy layer on surface of insect skin causing desiccation.
   - As an abrasive it ruptures insects outer layers and pierces internal organs.
   - Used as a dust on plant leaves.
   - Controls aphids and thrips; repels flea beetles and spotted cucumber beetles.
   - May also be used as wettable powder and sprayed.
4. Mating disruption for Codling Moth and Oriental Fruit Moth has proven to be an effective method of control. Placement of up to 400 pheromone impregnated twist ties throughout an orchard is necessary. Cost of treatment ranges from $44 to $110 per acre/year (Unterschutz, personal).

Most commonly used disease control materials:

1. Copper Fungicides:
   - Used against a wide array of fungal diseases and bacterial blights. Most copper materials are registered for use against powdery mildew, apple scab, early and late potato blight, peach leaf curl and pseudemonas.

1. Sulfur:
   - Used in elemental form or as component in fungicide and pesticide formulations.
   - Controls apple scab, rusts, powdery mildew and other plant fungal diseases. Also used as miticide in organic tree fruit production.
   - Common formulations and uses:

     a) Lime Sulfur prevents apple scab and provides good control of pear leaf blister mite if sprayed at leaf fall or in early spring as a delayed dormant spray. Pear psylla are also controlled with lime sulfur.

     b) Copper Sulfate is used as a wide spectrum disease control material. Copper provides a synergist effect which enhances sulfur's toxicity. Copper Sulfate is effective against all the aforementioned plant diseases and bacterial diseases such as pseudemonas and blight in Bartlett Pears.

     c) Bordeaux mixture is 8 lbs of hydrated lime and 8 lbs of copper sulfate mixed in 100 gallons of water. Bordeaux is used to control fungal diseases and is also an effective repellent to many insects, most notably flea beetles, grasshoppers and cutworms.

2. Over-use of copper and sulfur compounds could result in plant toxicity problems. Careful review of label instructions is extremely important.

BIBLIOGRAPHY

Brady, N. *The Nature and Properties of Soils*. 1974. Macmillan. New York, New York. USA.

Bugg, Robert L. *Cover Crops and Control of Arthropod Pests of Agriculture.* 1991. Sustainable Agriculture Research and Education Program. University of California. Davis, CA.

California State Water Resources Control Board. *Cover Crops Manual*. 1989. Sustainable Agriculture Research and Education Program. University of California. USA.

Callaway, B. M. *A compendium of crop varietal tolerance to weeds.* 1992. American Journal of Alternative Agriculture. **7**(4):169-180.

Coleman, Eliot. *New Organic Grower: A Masters Manual of Tools and Techniques for the Home and Market Gardener.* 1995. Chelsea Green Pub. White River Junction, Vermont. USA.

Culliney, T.W. and D. Pimental. *Ecological effects of organic agricultural practices on insect populations.* 1986. Agricultural Ecosystems Environment. 15:253-266.

Francis, C. A., and M. D. Clegg. "Crop rotations in sustainable production systems". *Sustainable Agricultural Systems.* 1990. Edwards, C. A., R. Lal, P. Madden, R. H. Miller and G. House. (Editors). Soil and Water Conservation Society. Ankeny, Iowa. USA.

Fraser, D. G., J.W. Doran, W. W. Sahs, and G. W. Lesoing. 1988. *Soil microbial populations and activities under conventional and organic management.* Journal of Environmental Quality. 17 (4): 585-590.

Goldstein, W.A. and D. L. Young. *An agronomic and economic comparison of a conventional and a low-input cropping system in the Palouse.* 1988. American Journal of Alternative Agriculture. 2 (2): 51-56.

Hainsworth, P. H. *Agriculture: The Only Right Approach.* 1954. Rateavers. Paluma Valley, California. USA.

Koepf, H. H. *Bio-Dynamic Agriculture: An Introduction*. 1976. The Anthroposophic Press. Spring Valley, New York. USA. p. 30.

Lampkin, Nicolas. *Organic Farming.* 1990. Farming Press Books. Ipswich, United Kingdom.

Luna, J. M. and G. J. House. "Pest Management in Sustainable Agriculture". *Sustainable Agricultural Systems.* 1990. Edwards, C. A., R. Lal, P. Madden, R. H. Miller and G. House. (Editors). Soil and Water Conservation Society. Ankeny, Iowa. USA.

National Research Council. *Alternative Agriculture*. 1989. National Academy Press. Washington D.C. USA.

Olkowski, W., S. Daar, and H. Olkowski. *Common Sense Pest Control.* 1991. The Tauton Press. Newtown, Connecticut. USA.

Parnes, Robert. *Fertile Soil: A Growers Guide to Organic and Inorganic Fertilizers.* 1986. AgAccess. Davis, CA.

Reganold, John P., *Comparison of soil properties as influenced by organic and conventional farming systems.* 1987. American Journal of Alternative Agriculture. 3 (4): 144-155.

Regnier, E. E. and Janke, R. R. "Evolving strategies for managing weeds". *Sustainable Agricultural Systems.* 1990. Edwards, C. A., R. Lal, P. Madden, R. H. Miller and G. House. (Editors). Soil and Water Conservation Society. Ankeny, Iowa. USA.

Riggle, David. *Why Farmers Become Composters*. 1994. Biocycle. 11: 58-62.

Schmid, O. and Klay, R. *Green Manuring: Principles and Practice.* Research Institute for 1979. Biological Husbandry. Switzerland. (translated by William Brinton Jr. for Woods End Agricultural Institute 1980.)

Shiralipour, A., D. B. McConnell and W. H. Smith. *Applying compost to crops*. Biocycle. 1993 6:70-72.

Small Farm Energy Primer, Bulletin 8.

United States Department of Agriculture. *Soil: Yearbook of Agriculture.* 1957. Washington D.C.

Werner, M.R. and D.L. Dindal. *Effects of conversion to organic agricultural practices on soil biota.* 1990. American Journal of Alternative Agriculture. 5 (1): 24-32.

Text written by Patrick Moore, Faculty, The Evergreen State College, Olympia WA
Text edited by Leslie Zenz, Sustainable Agriculture Coordinator, WSDA, Olympia WA

Organic Livestock Production

This section will focus on organic principles of livestock production, specifically for slaughter, dairy and poultry stock. Organic production of other animal stock such as bees, ostriches, emus and fish comprise a small percentage of livestock production and therefore have not been considered for discussion in this document. Some organic certifiers have developed standards for specialty stock like bees and fish. Oregon Tilth, Organic Crop Improvement Association, and Quality Assurance International have organic apiary (bee) standards. However, there is some debate over the validity of these standards. Organic fish production standards have been proposed by Farm Verified Organic. Please contact individual organic certification agencies for more information concerning these specialty livestock standards.

ORGANIC FARM AND STOCK PLAN

An organic livestock producer must have implemented farm and stock management plans in order to receive organic status. The plan must include long-term management of pasture, stock genetic selection, health care, pest control and feed supplements. Emphasis is placed on building up organic matter in the soil, which directly affects nutritive quality of feeds and ultimately the livestock. Soil and plant tissue testing are important in establishing a fertility management system in the early years of transition from conventional production. Improving mineral uptake, and maintaining appropriate ratios between calcium, phosphorous, magnesium and other micronutrients is critical to assure that livestock are adequately supplied to maintain good body condition and a healthy immune system for increased resistance to disease and parasites.

Many growers observe improvements in herd/flock health as they develop pasture rotations and farming practices that build organic matter, and reduce the need for toxic pesticides. According to Lampkin, many growers report increased fertility, fewer birthing problems, significant reduction in the incidence and virulence of disease, and increased longevity in dairy and breeding stock (279-281).

Organic farmers must take advantage of an animal's innate ability to thrive. Equally important is the choice of the appropriate livestock system for the particular piece of land, type of soil, climate and other factors beyond the control of the farmer. It is helpful to explore the types of livestock operations and breeds that were used in your region 75-100 years ago, and to make note of successes and failures. It is critical to keep in mind differences in susceptibility to diseases and parasites between cattle, sheep, goats, hogs and poultry. For example, it is difficult to control parasites in goats and sheep and care must be taken to avoid grazing on low lying lands where fluke is known to be a problem. In the selection of a livestock enterprise, a producer must consider parameters that range from building design to access to markets.

Record Keeping

Organic farmers must have a system in place that allows for accurate record keeping and identification of individual animals from birth to sale to ensure an accurate audit trail for certification requirements. All animals should be permanently identified and records should include the quantities of feed, which

foodstuffs were used, and all health care procedures. The record keeping system need not be elaborate; dedicating a file cabinet and a large calendar in the barn for recording observations and treatment is all that is necessary. Maintaining an individual card for each animal is a simple and easy way to track specific animals. Using such a system demonstrates the producer's effort to develop a farm plan which is an important part of most organic certification programs.

Producers should establish a relationship with a veterinarian who will support minimized use of synthetic medicines. There is currently a need for the development of organic therapeutic products for livestock. For severe infections, bacterial or parasitic, there may be times that a grower must treat an animal with conventional remedies to save its life and to prevent unnecessary suffering. To comply with organic certification the producers must maintain records to identify treated individuals and physically separate them from the organic herd.

BREED AND GENETIC SELECTION

Animals should be selected on the basis of their natural adaptability and resistance to known environmental stress, regional climatic differences, and endemic diseases. Steeper hillsides are more suitable for sheep and goats than cattle. Certain species are better adapted to certain forages. The physical framework of an animal is critical to ensure their physical capacity to handle sufficiently large volumes of roughage. Certain family lines exhibit strong variability in their resistance to disease. Certain breeds are better able to forage and thrive on marginal land.

Current breeding selection practices have placed us at great risk for losing the vast amount of genetic diversity that has evolved over centuries of animal husbandry. Until recently, in every region of every country, specific breeds of cattle, sheep, goats, pigs, poultry and horses were bred for their adaptability to particular environments. Today most breeding programs have focused on increasing production and away from regional adaptability. Breeds originating in the cool, and damp British Isles, such as Hereford and Angus do not thrive in the arid southwest, a region more suitable for hot climate breeds such as the Indian Brahma, which have large ears that act as automatic radiators for losing excess body heat. Selecting an appropriate breed for your region is the first step in maintaining a healthy stock.

There are several other factors the organic farmer needs to keep in mind when choosing an appropriate breed, selecting the herd sire, and culling of breeding stock. It is important to choose families with high disease resistance, longevity, fertility, structural integrity and good mothering qualities. Keep in mind that resistance to mastitis and metabolic diseases can be chosen as selection traits, similar to hardiness and ability to thrive on local or native forage.

HEALTH AND STRESS MANAGEMENT

For the grower committed to avoiding the use of synthetic antibiotics and parasiticides, attention to details that effect the health of the animals such as complete nutrition, sound genetic stock, good animal husbandry, a comprehensive disease prevention program and minimizing stress. Too often the areas in which animals are housed are overlooked in a health and stress management plan.

Housing and Shelter

Housing and handling facilities for livestock should be designed to meet the behavioral needs of each species. Each species has a set of behaviors that evolved to keep that animal healthy. In practical terms, this means sufficient room for normal species behavior, especially grooming and comfort behaviors. This means avoiding overcrowding and allowing animals the opportunity to seek the

company of others as well as avoid it. There are many specific requirements in housing animals that work to reduce fear and suffering.

Occasional tethering is reasonable, but not for extended periods of time. Hogs enjoy the search for food and become bored and frustrated in confinement systems. Chickens like to scratch, dust and feed frequently. Without the opportunity to fill their time with these types of activities a host of aberrant behavioral traits develop that become management problems.

For hogs, privacy at birthing is important, as are family groupings as piglets move through weaning which can be done over a longer period of time. Hog facilities can be designed so that sows have freedom of movement and piglets can still escape her when she lies down. Appropriate access to pasture and exercise, and comfortable resting sites are critical for both sows and high producing dairy cows. Exercise decreases metabolic diseases, difficulties in birthing and improves the likelihood of breeding. A number of innovative housing ideas are being developed for hogs that allows movement and access to pasture (Lampkin 304). A renewed look at pasture farrowing compares favorably with confinement systems; the hogs appear more content and the farmers enjoy their work more (Cramer 18-23). There are also new designs being developed for dairy loafing sheds and broiler houses.

Poultry need room to dust for mites and sufficient perch space for roosting. Staggering the height of roosting perches for poultry can reduce cannibalism in large flocks where it is difficult for birds to establish a pecking order. Roosters can also serve to reduce stress and cannibalism in the flock by spreading the hens out over the pasture. Roosters naturally create space between one another while hens tend to congregate around a rooster. An effective ratio is one rooster to twenty hens.

Sufficient and clean bedding is important for preventing problems associated with poor sanitation. For the dairy loafing shed, this is critical to ensure udder health and minimize the occurrence of mastitis. When weather forces cows, ewes and sows inside, clean and ample bedding is critical, especially for newborn animals, to prevent chills and exposure to filth. It is important to provide shelter from intense sun and winter wind. When housed, adequate ventilation is critical to prevent respiratory illnesses.

Stress Prevention

A common cause of stress in livestock is their shipping and handling, particularly at auctions. Most non-organic stock are routinely dosed with antibiotics following these activities because of the high incidence of respiratory disease and scours. Livestock facilities should be designed to avoid the need for electric prods and take advantage of natural behaviors to move the animals. Shipping should be minimized and overcrowding eliminated. During transport, stock shouldn't go without water for more than 10-12 hours, less in hot weather and for young animals, nor should they go more than a day without food.

Management practices such as dehorning and castration should be done when the animal is still young and during cooler weather to minimize fly problems. Colostrum, antibodies contained within mother's milk, is critical for newborn animals for at least two days, and therefore immediate separation should be avoided. Common baking soda added to the drinking water of stressed animals may restore proper pH in the gut. Probiotics, such as acidophilus, may help reestablish beneficial bacteria in the gut to combat digestive problems. These practices are necessary for success in any livestock management system.

NUTRITION MANAGEMENT

Proper nutrition is critical to ensure healthy, resilient stock. Certified organic livestock must be fed certified organic feed during all or part of the animal's life depending on the certifier's requirements. Clean, uncontaminated water at moderate temperatures should be available. It is essential to have a clear understanding the animal's digestive system and requirements for specific stages of production. Young, rapidly growing plants in the pre or early flower stage offer the best quality nutrition and should make up as much of the forage as possible. Large quantities of high quality roughage should provide as much energy and protein as possible. Concentrated supplements should be used only when necessary. Poultry feed requires far more than simply mixing grains and protein levels. The right balance of amino acids, vitamins, minerals, tannins, mold spore, and calcium levels must be considered for starter, grower and layer mixes to prevent toxicity problems.

One method that is being explored is the practice of cafeteria style feeding. Each component is measured and all of the feedstuffs are offered separately to the animals. Consideration should be given to what foods and in what ratios the animal would choose at liberty. Animals will seek a far more varied diet than grass and corn. As with humans, increasing the diversity of foodstuffs available will improve health and disease resistance in livestock. It is important to provide a selection of plants in a pasture that exhibit different growth habits. For example, planting a mixture of deep rooted with shallow rooted plants increases the diversity of minerals brought to the surface and incorporated into an animal's diet. It is common to plant a variety of grasses and legumes. In areas not conducive to growing corn, consider other crops for winter fodder, such as turnips, parsnips and sugar beets. Kale makes excellent winter grazing. Even more intriguing is the practice of including other herbaceous plants into the pasture mix that we might normally think of as weeds. Juliette de Bairacli Levy, in her book The Herbal Handbook for Farm and Stable, suggests a long list of plants, many of which have medicinal value. A partial list might include: dill, comfrey (avoid use with milking goats), garlic, hyssop, marjoram, horehound, borage, salad burnet, plantain, chicory, yarrow, sheep parsley and caraway, native prairie species, or lower woodland shrubs (30-136). These can be added to a pasture mix or incorporated into hedgerows. It is important to research the medicinal plants that you use in this manner, as some can have toxic effects on both livestock and humans.

Experience has shown that grasses tend to out compete most other classes of desirable species in a pasture situation. Though recommended seeding rates of the herbaceous plants listed above need only comprise 3% to 5% percent of a seed mixture, the seed can be costly and the stand may fail to achieve the longevity necessary for sufficient economic return. Some success has been reported on British farms where strips of ground, rather than entire fields were prepared and planted. Some protection from overgrazing might also be useful for plant species with high palatability, such as plantain (Lampkin 332-330).

Detailed observation of land and pasture over time is a skill well worth developing. It will be useful to measure a square plot in some part of your grazing land to observe over time, recording species composition and rate of regrowth. Allan Savory's model for Holistic Resource Management is an excellent source to use in developing a grazing system that takes into account many important parameters. He has demonstrated that the recovery time after grazing is more important than how much grazing pressure occurs. This is especially important in dry environments. The goal is to use high impact grazing to quickly graze down a paddock and then remove the animals until the grazed plants recover fully. Savory has demonstrated that roots die off as above ground material is removed. The roots regrow as the top regrows. Overgrazing occurs when the newest regrowth is removed

before the roots reestablish and it is this pressure that decreases the health of the desired species and allows less desirable, less palatable plants to dominate the pasture over time (Savory 513).

Using Savory's model, a pasture or range might be divided into 10 to 25 (or more!) separate paddocks. The length of time to keep stock in a particular paddock will be influenced by temperatures, rainfall and site conditions. When grass is growing quickly, it is easier to overgraze the site if the animals are allowed to remain in paddock too long. Since most livestock relish new shoots, they will come back and graze the new growth before eating more mature plants in the same field. However, with rapid growth, the rest period is reduced and animals can be allowed back into the paddock sooner. If dry, hot, or cold conditions exist, a longer resting period is required due to a slower regrowth rate.

It is important to develop the habit of asking yourself questions when considering the health of a pasture. It is useful to ask the following questions: What would have grown here? What plants do wild animals eat during times of stress? Does their preference change during the season? Does confinement behind fences limit the animal's ability to heal itself by seeking specific plants? These types of questions are useful in determining the best management strategy. The key point is livestock are capable of self balancing their diet and we need to question our assumptions about what constitutes proper feeding in order to develop more appropriate models for feeding systems.

Stocking Density for Pasture Land

Establishing appropriate stocking rates is a challenging task. Decisions are effected by yearly rainfall and weather fluctuations. While it is prudent to err on the conservative side, economic pressures demand the best use of on-farm resources. The producer must balance grazing requirements with the need for putting up hay or silage, creating clean ground for young stock, and avoiding overgrazing. Appropriate access to pasture includes the ability to avoid damaging pasture during drought, wet or freezing weather.

Sometimes one plus one equals three. Combining animals with different grazing patterns either together or in rotation, allows for more efficient harvest than if there had been only one species grazing that land. Poultry can follow cattle, scattering manure piles and eating fly larvae. Sheep can also follow cattle, breaking parasite-host cycles and grazing plants the cattle left behind.

There are many management tools to increase the quality and quantity of pasture. Electric fences, both permanent and portable, allow for the redesign of traditional grazing patterns. Fencing systems have evolved to fit every region and type of operation. Short-duration, intensive grazing on up to 25-30 small paddocks can greatly improve stocking density, palatability, nutritive quality, number of grazings or cuttings and weed control. This principle is also critical for successful parasite control.

Hedgerows

The hedgerow may be considered where permanent fences are used. Hedgerows provide multiple benefits:

- Beneficial insect and bird habitat,
- Wind breaks,
- Permanent low maintenance fencing, and
- Plant foods for pastured livestock and wildlife.

Again, the lesson here is to learn to observe natural systems. Identify the strengths inherent on your farm and make them work for you (Levy 18-20).

DISEASE MANAGEMENT

The importance of maintaining a segregated herd can't be overemphasized. The stockperson can undo all other efforts if, through carelessness, s/he allows intermingling of clean and unproved stock and introduces disease and parasites from off the farm. Farmers should include a quarantine or isolation area in the farm plan. These areas should be used to separate newly purchased stock and to remove sick animals from the herd/flock at the first signs of disease. It should be easy to clean and sanitize and allow for the safe inspection and treatment of animals. Producers should avoid using untested bulls in areas where endemic disease is prevalent. If purchasing new breeding stock, virgin animals should be considered. It is in the best interest of the producer to develop relationships with suppliers that employ techniques that augment your own efforts.

Disease Prevention

The evolution of veterinary medicine is closely linked with modern diseases associated with intense confinement, rations high in concentrates and low in roughage, stressful shipping, and overcrowding. Most metabolic disorders disappear when stock are fed sufficient quantities of high quality roughage and allowed the liberty of exercise. Birthing problems often diminish when the dam has sufficient exercise for adequate muscle tone. Respiratory ailments are minimized when ventilation is sufficient and animals aren't forced to breath fumes from the excrement of thousands of other beasts. Likewise, foot problems and cannibalism decrease when stock are given access to pasture and aren't confined on concrete and in wire cages.

The basic elements must be provided; air quality and adequate ventilation is crucial for controlling respiratory ailments, and sufficient clean water must be provided at appropriate temperatures, filtered if necessary. Nursery pens should be properly cleaned and disinfected between uses to eliminate the spread of disease. Visitors from other farms should disinfect their feet before entering facilities to prevent disease from being carried to your farm. Frequent checking of stock, especially during birthing times, extremes in weather, and change in feeding or other basic scheduling will help with the early detection of problems. Stock animals are creatures of habit and a regular feeding and handling schedule keeps them healthy and content.

Alternative Treatment

Though alternative treatments are limited and expertise is scattered across the United States, there are a growing number of veterinarians interested in homeopathy and natural healing systems. Though few have specialized in livestock, many are working with companion animals and may be interested in diversifying their practices. Acupuncture is used increasingly to help treat physical ailments and several specialists are currently working with race horses.

Juliette de Bairacli Levy has detailed information on medicinal plants, their preparation and methods of use for the various farm animal species (30-136). At this time, the option of using herbs is hindered by lack of approval by the Food and Drug Administration (FDA), limited available knowledge of use and efficacy, and a lack of convenience for use by the producer. All health and feed inputs must be approved by the certifier before being administered to livestock. Few producers have the time to gather and/or prepare herbal products for use. For this reason, incorporating herbs in the pasture or hedgerow provides the animal the opportunity to seek a broader diversity of plants which may reduce the incidence of disease and with it the need for treatment. It should be noted that the use of some medicinal plants can have a toxic effect on the milk produced from animals that have been treated. For example, comfrey fed to milking goats can cause lysergic alkaloid build up in their milk which has a toxic effect on humans. Homeopathic treatments are safer for use in treatment as the level of potentially toxic constituents

is far below harmful levels. Other options available to organic farmers include other natural treatments, nutritional supplements, and probiotics.

PEST / PARASITE MANAGEMENT PROGRAM

The practice of observing natural systems is important in parasite control. Native grasslands throughout the world that have supported large numbers of grazing animals tend to experience extremes in weather. Some examples are: western US prairies, the grasslands of South America, and the Savannah of Africa. The original herbivores ranged in migratory sweeps and were followed by extremes of weather that served the purpose of reducing infection cycles. Farmers on 20, 200 or even 2,000 acres obviously can't recreate these conditions, but they can avoid the use of synthetic parasiticides by taking advantage of the rules of nature. The goal is not necessarily to eliminate all parasites. Animals that are otherwise healthy can remain healthy even with low parasite loads. The goal is to control parasite populations and livestock exposure to them so they don't build to the point of causing problems or economic loss. To plan a parasite control program, many factors need to be addressed:

1. Identify problem pests, both internal and external, and their lifecycles;
2. Manage pastures to prevent increased parasite populations by: establishing clean ground, maintaining appropriate stocking rates, and developing appropriate grazing patterns;
3. Improve sanitation and manure management;
4. Strategic use of parasiticides, natural and synthetic (when necessary); and
5. Maintain high degree of immunity through good health.

Identify Pest Problems

It is important to correctly identify insect pests and to have a clear understanding of their life cycle. Veterinarians can assist in identifying pests and with the development of a parasite control program. There are several other ways that you can learn more about problematic pests. Use a calendar to chart each pest's life cycle. Insect populations are controlled by weather, where temperature and rainfall affect the hatch and pupation of the parasites. Compare pest life cycles with the growing season. This knowledge can be integrated with grazing and mowing schedules, crop rotations, and building sanitation. A calendrical map that shows the times of the year that a field is safe to graze or best cut for hay is helpful.

As with organic crop production, control is easier to achieve before pest populations build. Traps can be used before fly populations explode. Incorporating insect traps at entrances to barns or at feed and water troughs will help control fly populations. There are several new types of traps available on the market. Rolls of sticky tape or traps that attract flies and prevent their escape are both very effective. Targeting different types of traps for specific insect life cycles will complement other sanitation efforts for fly control. Check animals for lice, ticks and mites before mixing groups of animals together. When treatment with synthetic drugs is necessary, incorporate specific prevention techniques simultaneously. Prevention is an important tool in controlling pests.

Pasture Management for Parasite Control

Establish Clean Pasture

It is important to understand the differences between clean, safe pasture and infested pasture. Use this understanding to manage grazing schedules according to the susceptibility of different age classes or species. Older stock with acquired resistance can be grazed safely on land with low infestations of parasites and not become severely infected. The grazing schedule should provide

sufficient ground for young stock which have little resistance to parasites and require clean land for grazing. Set aside 10-20% of grazing land each year for clean grazing ground the following spring.

Pasture is considered clean when:

- It has been rested 12 months (Lampkin 325-327; Shirley 20-25);
- Hay or silage was cut with no winter grazing; and
- Ground is newly seeded after a crop is harvested.

Safe pasture may have been grazed in the fall, and have reduced parasite loads due to winter weather or harrowing fields to break up manure piles. Effort should be made to provide for mechanical forage harvest, which eliminates parasites through drying. Also, practice rotations allowing for fallow paddocks, grazing by non-susceptible species, or rotations with other production such as row crops.

Maintain Correct Stocking Densities

Appropriate stocking numbers are crucial to successful parasite control. The number of grazing animals directly determines how land is managed, where animals spend their time and the level of parasite infestation. More information is becoming available on a regional basis that reflects changes in recommended stocking densities for protection of riparian areas and enhancing the value of forage harvested from grazing lands.

Develop Pasture Rotation to Meet Specific Goals

Plan a rotation cycle that takes an animal's natural immunity and susceptibility into account. Research the best rotational strategy for your production system, keeping in mind that each species has it's own set of requirements and benefits. For example, sheep and cattle are generally not susceptible to each other's parasites, and alternating grazing between the two species can be used to break the infection cycle. Generally speaking, older animals develop resistance to many parasites commonly found in their regions. In temperate climates, the main infection period for sheep is mid to late June after the weather has stabilized. For cattle, the infection period comes with the onset of higher summer temperatures after mid July. It is important to rotate animals from pasture land by early summer to ensure that pasture will be clean the following spring. In early spring, sheep tend to shed or expel large numbers of parasite larvae which then would contaminate that ground for the lambs. Ideally the first three months of a lamb's life would be on clean ground. A ewe's natural resistance falls to a low during lambing and lactation.

Many animals pick up immunity to disease and increase weight gain by remaining with their dams for longer periods. For example, if sows are run with mixed ages between farrowing, they are exposed to many potentially harmful organisms and through exposure, their own immunity increases with age. This immunity is passed on to successive litters through the colostrum (Lampkin 382-391). Care should be taken however to keep the dam from crushing piglets when they are allowed to remain together. For certain problems it may be helpful to segregate weaned stock from older stock and reserve clean ground for young animals. It is always better to first graze weaned stock and follow with older animals rather than the reverse. When the use of anthelmintics, or de-worming treatments, is necessary, animals should be treated and then moved to clean ground to keep parasite populations under control for longer periods of time. Anthelmintics are currently being considered for approval by the Organic Materials Review Institute.

Moving away from a system that utilizes only one or two large pastures has many advantages, including better herd health. Establishing a safe grazing areas for young stock will require several paddocks and planning ahead six months, or more, for ground that will be free of stock prior to winter.

Attention should be paid to the type of pasture you have and it's suitability for grazing. Low, wet areas tend to harbor more pests. If possible, look into draining wet areas that continue to re-infect your stock or choose instead to develop the wetlands potential of the site.

Sanitation and Manure Management

The appropriate management of manure is critical not only for nutrient conservation, it is also an important component of a parasite control program. Harrowing pastures or using chickens to break apart manure piles exposes eggs and larvae to hungry birds and the desiccating effects of the sun. Sanitation of housing and operational facilities is critical. Free range chickens, geese and ducks that dine on many insect larvae can significantly decrease insect populations.

General sanitation practices include:

1. Removing manure from walls
2. Periodic cleaning of dust and debris
3. Replacing all bedding
4. Keeping water and feed troughs free of manure and old feed (especially for poultry)
5. Eliminating piles of manure to remove insect breeding areas
6. Fly traps to control horn flies
7. Chlorine shoe drenches for visitors to kill off-farm bacteria

Considerations for fly control system designs:

1. Timed release of fly predators and parasites
2. Darken barn, flies move toward light
3. Diatomaceous earth and pyrethrum root dry mix for outdoor spreading
4. Dolomite lime on floors and yards
5. Stinky jar and sticky paper flytraps
6. Clean up of fly breeding areas
7. Microbial inoculant to disrupt fly life cycles
8. Maintain nutritional balance of rations
9. Diatomaceous earth in window sills
10. Electric fly zappers
11. High powered fans in barns
12. Sweep or dust bag to brush off animals as they enter barn
13. Vegetable oil and soap sprays (Siemons, personal)

Strategic Use of Parasiticides

Adhering to a philosophy of humane treatment of animals, nearly all certification agencies require that conventional treatments are not to be withheld from a critically ill animal in order to sell that animal, or its products as organic. When treated, the animal must be removed from the organic stock and kept separately. The animal may or may not be returned to the organic stock depending on the type of production system and the organic certification agency's policies. Until such time that natural treatments for worming are tested and approved for domestic livestock by FDA, producers are left to their own experimentation. The use of food quality diatomaceous earth in the rations, herbal worming compounds (garlic, neem) and homeopathic remedies (Cina, Chenopodium, Granatum, Sabadilla, Filix mas) are examples of controls currently being explored by organic farmers. If, after all efforts, parasite levels build to the point of requiring conventional treatment, try to use those parasiticides that are least toxic to the animal.

Ensure a High Level of Immunity

As with disease, animals that are supplied with sufficient quantities of quality feed and maintained in a clean environment with a minimum of stress acquire better resistance to parasites. Genetics, climate and specific aspects of geography all play an important role in providing for a high level immunity. Appropriate exposure to pests can boost resistance. Promoting herd and flock vigor will contribute to a successful parasite control regime.

LABELING AND SLAUGHTERING RESTRICTIONS

Until recently, the USDA had placed a restriction on the labeling of meat as organic. In January of 1999, this restriction was lifted and now producers are allowed to label their meat products as organic provided that they are certified by an accredited organic certification agency and that their specific label has been approved by the USDA. There are no restrictions to labeling egg and dairy products as organic as long as you are certified.

Organic meat that is sold through retail must be slaughtered at a USDA licensed and organically certified slaughtering facility. Organic animals that are sold directly to the consumer can then be slaughtered by a licensed and organically certified custom slaughtering service. All USDA requirements for the sale of meat apply to organic producers as well as conventional producers. Federal and state regulations for slaughter and packing facilities are becoming more stringent and fees have increased. Most slaughter facilities are geared toward high volume processing and it has become more difficult for small producers to slaughter, process and sell their products. It is important for growers to work together to take advantage of economies of scale in purchasing feed and shipping stock to slaughter as well as in developing marketing strategies.

BIBLIOGRAPHY

Heady, Eleanor. *Coat of the Earth: The Story of Grass.* 1968. Norton: New York.

Hilgard, E.W. *Soils.* 1910. The MacMillan Co.: London.

Irwine, Mike (ed.). *From the Ground Up: Wisconsin Sustainable Farmers Tell Their Practice and Vision.* Madison Technical College: Madison, WI.

Lampkin, Nichols. *Organic Farming.* 1990. Farming Press: United Kingdom.

Levy, Juilette deBairaeli. *The Herbal Handbook for Farm and Stable.* 1976. Rodale Press: Emmaus, PA.

Lust, John. *The Herb Handbook.* 1974. Bantam Books, Benedict Lust Publications: Sini Valley, CA.

Mason, Jim and Peter Singer. *Animal Factories.* 1980. Crown: New York.

Pitcairn, R.H. and Pitcairn. *Dr. Pitcairn's Complete Guide to Natural Health for Dogs and Cats.* 1995. Rodale Press: Emmaus. PA.

Savory, Allan. *Holistic Resource Management.* 1990. Island Press: Washington, D.C.

Text written by Ann Schwartz, Blue Heron Farm, Concrete, WA
Text edited by Leslie Zenz, Sustainable Agriculture Coordinator, WSDA, Olympia WA

Organic Marketing

"Organic farming is not something to jump into for quick profits. Rather it is a long term commitment to a different way of farming"
– Eric Gibson, author of Sell What You Sow

Organic farming has grown from small farms and cottage businesses into a $3.5 billion industry. The industry has grown more than 20% each year for the past seven years. Although it is still a small part of US agriculture today (about 2% of retail food sales,) organic production is one of the fastest growing sectors. There were over 5,300 farmers certified in the US in 1997 (Organic Farming Research Foundation, 1997). In addition, the number of acres devoted to organic production has increased since 1991 from 550,000 acres to 1,127,000 acres in 1994 (National Agricultural Library 1996). Demand for organic products in foreign countries has also risen during this same time period. Most certified organic producers in the 13 major vegetable-growing states have become certified within the past eight years (81%.) Most organic farmers are between the ages of 36 and 55, college educated, and listed farming as their primary occupation (Agricultural Resources and Environmental Indicators 1996).

Requirements for Selling Organic Products

An organic producer farming in one of the states that have organic laws and rules (*see the State Organic Laws Quick Reference table*) must produce according to those rules in order to market a product as organic whether certification is required in that state or not. Some states laws, as well as the US Organic Food Products Act (OFPA) exempt small growers from certification requirements. Farmers with less than $5,000 gross annual sales revenue from agricultural products (includes value of conventional product for split operations with both conventional and organic production), may label and market products as organic *for direct sales to consumers* without the need for certification.

To market organic food as a "certified" organic product, the producer must be certified by an organic certification organization and present an organic certificate to the buyer. Certified farmers selling directly to the consumer must be able to present the organic certificate upon request. If a food product is not represented as "certified," the customer cannot be assured the chain of custody and organic integrity from the farm field to market has been adequately maintained.

Market Trends

This section provides a brief overview of the market trends for certified organic products. The subject of marketing has many facets which have been covered in depth in other published materials (See *Publication Resources,* in the Reference Section, pg. RS-16).

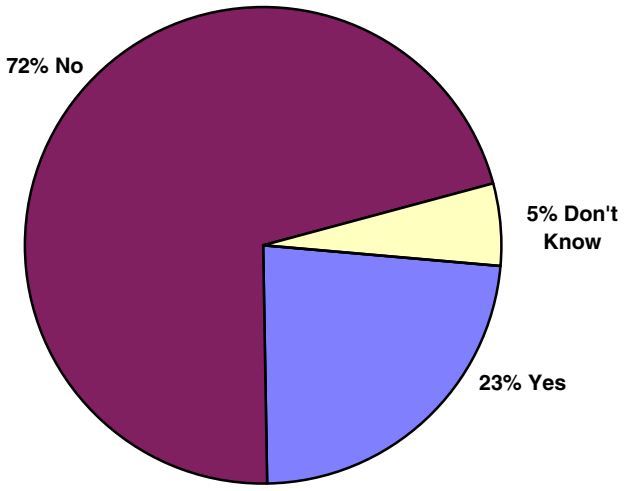
The organic industry represents about 2% of the total food industry. Despite this current percentage, the organic market should no longer be considered a niche market. The majority of organic food is found in local farmers' markets, up-scale specialty restaurants and natural food stores. However, increasing numbers of supermarkets are carrying an organic produce section and

adding other organic products to their shelves. Larger scale organic producers and organic product lines with sufficient quantities are continually making their way to an expanded marketplace that now includes mainstream supermarkets and international export markets. The continued growth in the number of natural foods stores, 14% per year over the past five years, compared to 3.3% per year for mainstream supermarkets, also helps increased sales of organic products.[1] Some of the more recent product debuts include organic milk, cheese, chocolate bars, baby food, frozen dinners, and wine. Organic farmers have a unique marketing position for offering food products to the increasing number of consumers who want food produced without synthetic pesticides, fertilizers, and which has not been genetically modified.

Since 1983, *The Packer* newspaper has sponsored 13 major consumer studies to track the purchasing and consumption of fresh produce. During June of 1995, one thousand nationally representative households were interviewed via telephone. Questions about the consumer and his/her organic produce consumption were asked in an open-ended format (as opposed to multiple-choice answers). The margin of error is calculated at 3.1%[1] The following graphs are pulled from the 13th study conducted by *The Packer*:

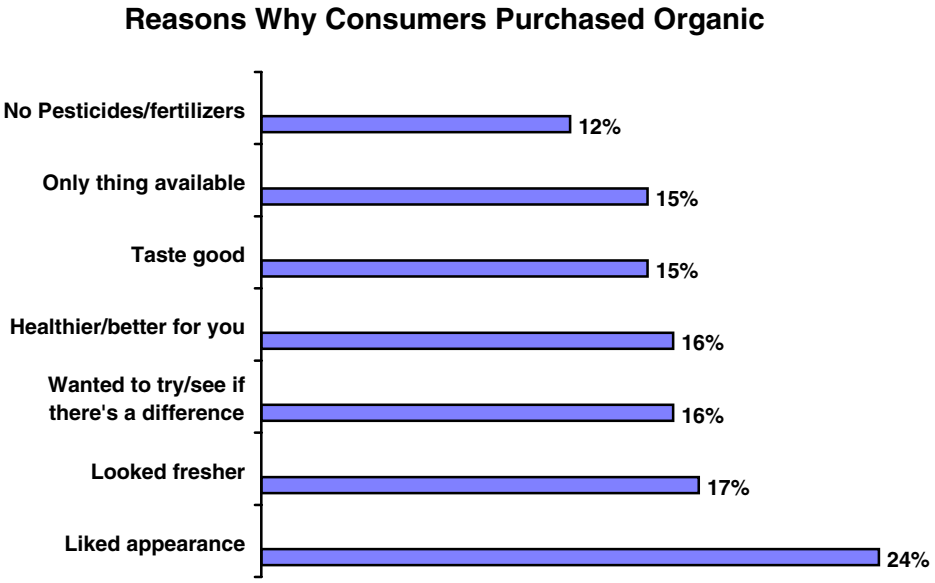
The Organic Consumer

Have you purchased organic produce in the last six months?

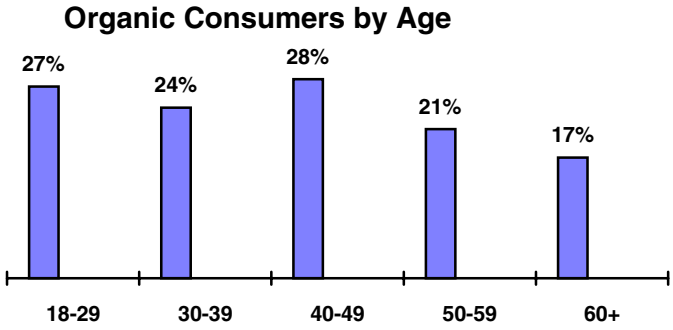


Of those consumers who purchased organic produce, the majority (41%) based their choice on appearance and freshness.

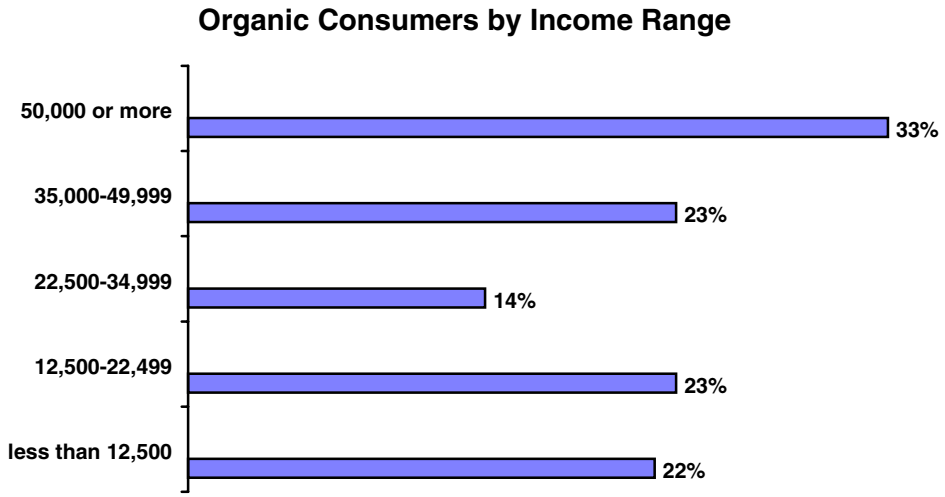
[1] "Fresh Trends 1996: A Profile of the Fresh Produce Consumer; Selling Organics," The Packer. Vol. CII, 54#, 1996, p. 72.
[2] Ibid, p. 4.



Organic produce is purchased by every age bracket. The 40-49 year old range shows slightly more interest in organics than the 18-29 year old range.



Consumers within all income brackets purchase organic produce. All three graphs show that organic produce is purchased by nearly a quarter of the population of all ages and income ranges. Appearance and freshness are the prime motivators for one to make an organic purchase.



In 1996 and 1997, The Hartman Group, a business marketing consulting firm, at the request of The Food Alliance, conducted a survey of consumers to determine which segments of the population were purchasing organic and earth-sustainable products. Their results were suprising, but reconfirmed the continuing growth of the organic industry and the potential market support behind it.

The Hartman report showed that 52% of consumers had a desire to buy "earth-sustainable" food products, but of these, most do not because they could not find products that reflected their core purchasing criteria. It is suggested that knowing what the consumer wants has been the element missing from almost all previous attempts to market green products. In order to further clarify the market for green products, American consumers were identified as falling into six different segments. These segments are listed below :

The Unconcerned (18%) : This group rejects the idea that the health of the environment is threatened. This group is very unlikely to buy anything that represents a green perspective.

The Overwhelmed (30%) : People in this group are too concerned with personal economic survival to worry about the survival of the environment. This group is also very unlikely to purchase green products.

The True Naturals (7%) : These consumers have a passionate commitment to saving the planet which is reflected in their purchasing choices. This segment represents the core market for organic food.

The New Green Mainstream (23%) : This group cares deeply for the environment, but they don't know much about it and will only purchase green products if they can see added value. This group represents the second core marketing segment of organic and sustainable products, but they need education about buying green and the presentation and availability of products will have to provided in a palatable format.

The Young Recyclers (10%) : This group is comprised of mostly unmarried and young consumers who are concerned about environmental issues, but currently cannot afford to pay the

premiums associated with green products. As this group moves through time, their purchasing power will increase and add to the market base for green products.

The Affluent Healers (12%) : High income, highly educated, and care most about the health of their families. Their concern for environmental issues pertains to the effect it has on their immediate personal well being and they are often cynical about the hype often associated with green products. If this group is presented with substantive, high-quality, and non-gimmicky information about green products, then they could play a significant role in the green marketplace with their affluent purchasing power.

The Hartman group concludes by saying:

> " Perhaps the most important insight we can glean from the data in this study… is that the environment, except for the True Naturals, is not the driving factor in… purchase criteria. Depending on the product and depending on the consumer; price, convenience, availability, and quality are more important. But for the three segments in which we have detected a latent desire to buy earth sustainable products [New Green Mainstream, Affluent Healers, and Young Recyclers,] we see the 'environment' slowly moving into their core purchasing criteria, and all other factors being equal, can easily become the tie breaker. Producers need to know that there is a significant demand for earth sustainable products if they are to be motivated to substantially change their production methods. Environmental educators need to know that they can achieve positive change for the environment by focusing their effort more on consumer education. This study shows that a significant number of consumers want earth-sustainable products, but they need to be better educated about how to make earth-sustainable purchase choices that will make a difference. They need to know that they are the missing link and that they, more than any other player in the environmental drama, can be the engine driving the changes that can help heal [the] earth." [2]

Marketing Options

The marketing options for organic farmers are similar to those for all growers. All farms must develop a marketing plan based on the scale of production, available labor and capital, the personality of the farmer, and market research. Most small and mid-size growers will often use a variety of marketing options for farm fresh produce or farm processed goods. A typical 10 acre farm that produces annual row crops might sell at a farmers' market, have a Community Supported Agriculture program, and wholesale a select crop or two. This way, all of your eggs are not in one basket! About half of the organic farmers surveyed market their produce directly to the consumer, 10% to a retailer, and 14% sold to wholesalers.[2]

The important thing to remember with all marketing options is that they are all based on relationships. Knowing the expectations of your market, communicating clearly, following through with commitments, and being aware of your limitations are important aspects of any relationship.

---

[2] Food and the Environment: A Consumer's Perspective. Phase 2, The Hartman Report, 1997.
[3] AREI Updates; Updates of Agricultural Resources and Environmental Indicators. USDA's ERS. Number 4, May 1996

Tips for Successful Marketing

- Remain consistent with the quality of your product and customers will return again and again.
- Don't undersell yourself. Determine the cost of producing your product, set the price and stay there. By offering bargains, customers will come to expect low prices and be turned off when they have to pay more next time.
- Likewise, don't undersell your neighbor. Keep pricing fair. By lowering prices, you may sell more product, but everyone loses in the long run. Organic farmers need to play for the same team.
- Remain attentive to changes in market trends. Consult gourmet, food trend, and other magazines or periodicals for ideas and updates. Flexibility and creativity will win every time.
- Consider adding value to your product. Examples of added value are: Flower bouquets with gift cards, specialty jams and sauces, and pre-washed and mixed packages of salad greens. Remember to research state and county laws and regulations regarding the processing of food.
- Always deliver on time with the product that you promised.
- Be organized. With any marketing technique, it will benefit you to know your product well, your prices, how your display will look, where your receipt book is, when you can deliver next, and a multitude of other organizational qualities will allow you to present yourself as a professional.
- Marketing techniques used by makers of products other than food will also work for farmers. Packaging, advertising, and a unique product are examples of these techniques.
- Utilize your advantages. Do you have a beautiful old farm that is attractive to on-farm customers? Consider agri-tourist activities. Do you live in a diverse community with many different ethnic backgrounds? Consider catering to the tastes of the different people who live around you.

Direct Sales Marketing Options

Direct marketing often allows for a greater return on your product. However, consideration of this type of marketing should address the time and cost of selling the product yourself. Direct marketing also necessitates a personality conducive to dealing with the public. Organically produced goods are purchased by consumers who are drawn to freshness and appearance of the product, as well as a concern for the means of production and, therefore, are likely to seek a direct way of purchasing. This creates an advantage in direct marketing for the organic producer.

Community Supported Agriculture

Community Supported Agriculture (CSA) is a marketing system where customers buy "shares" in a farm's harvest. They pay a fee at the beginning of the season, thus providing the farm with up-front capital. In return, each customer receives a weekly allotment of produce. The produce is either delivered to a customer's door, a drop-off site, or can be picked up at the farm. This type of marketing should be employed only by a well experienced farmer. The idea, in theory, behind CSA programs is that the "shareholder" takes the same risk as the grower throughout the season. However, in practice, the farmer must deliver a steady supply of product if he/she wishes to retain customers for the following season. This option is also used for marketing flowers, animals, and single crops. There are also collective CSA programs where a group of farmers combine their produce to then be divided into shares for customers. These programs allow for a wide offering of produce for the customer, without requiring a single farm to produce everything. Collective programs also are able to have a larger customer base than a single small farm might be able to supply.

U-pick Marketing

Crops that are best suited for u-pick marketing are those which harvest easily and where ripeness is easily determined. Small fruits and Christmas trees are the most common u-pick crops. Be aware that most states require liability insurance for these types of operations. U-pick is a good method for saving in harvesting labor, but managing the public effectively for sales transactions, and to ensure thorough harvesting can require a great deal of time. Clear signage directing "pickers" to the farm and ample parking is essential.

Farmers' Markets

Farmers' markets are the most common place for new growers to get their start. At a farmers' market you can learn all the nuances to successful marketing of your product, current trends, and customer expectations. Visit the market where you plan to sell, and talk with other vendors. Make note of what types of products are being sold, how they are displayed, and what niche may be under utilized. There are several elements to selling at farmers' markets that can enhance sales: cleanliness in appearance of both the product and the seller; abundance (or the appearance of abundance) of product is attractive to the customer; engage the customer by giving a story or a recipe with the product; keep busy by sprucing up here or re-stacking there to give the appearance that you are recovering from a rush on your product; consider offering samples of your delicious product for customers to try. Each farmers' market will have a set of rules and regulations concerning fees and what or how products can be sold.

Mail Order

Mail-order marketing through catalogs and/or creating a website on the internet describing your farm and products is an excellent way to reach a wide audience. Mail order marketing is best used for products with a long shelf life and that are easily packaged for shipping. Marketing with this method requires attention to effective organization for the maintenance of a database of catalog recipients, publishing a catalog or maintaining a website, and receiving, packing, and sending orders. Selling through an established catalog company may save organizational time and effort, but the price you receive for your product will be less, and your name may not accompany your product.

Roadside Stands

There are several different ways in which to operate a farm stand, ranging from simple, self-serve stands to elaborate roadside attractions. Self-serve stands require very simple and clearly written directions for the customer to follow and preferably a locked, slot-drop box for payment. Elements for success in marketing with this method are: refrigeration keeps your product looking fresh; a variety of different products (some stand owners will buy product, fresh or packaged, to augment their own); clearly written and eye-catching directional signage; convenient access from a main road and ample parking. Contact local state and county agencies for details regarding permits and licensing.

Direct to Retail Stores and Restaurants

Direct sales to retail stores and restaurants both require a steady supply of seasonal produce and a strong working relationship. In seeking out restaurants, select more up-scale restaurants that like to boast that the food they prepare is organic or locally grown. Inexpensive and franchise restaurants may not be able to give you a competitive price. Grocery stores are often willing to buy directly from the grower, but are concerned with consistent supply and strict quality standards, much like wholesale distributors. Independently owned and alternative market stores are more likely to deal directly.

Entertainment Farming

Also known as agri-tourism, entertainment farming is becoming a popular way to attract customers. There are several ways to incorporate entertainment on your farm. People are attracted to nostalgic images of farming and activities in which they can participate. Hay rides, and apple bobbing activities that augment a u-pick pumpkin patch, petting zoos, and strawbale mazes are examples of this type of augmentation to direct marketing techniques. Be aware, however, that managing the public requires a great deal of patience and the right personality.

Wholesale Marketing Options

Larger volume producers will often select a wholesale marketing option, which usually requires a consistent flow of product, whether it is fresh produce or a processed good. Wholesale marketing eliminates the time needed personally to sell your product and can be an easy, but risky market strategy. This type of marketing requires specific packaging; a cost supplied by the farmer (with the exception of packers/shippers who supply the packaging.) Also, large scale production often requires expensive, specialized equipment in the field. Wholesale companies are required by their buyers to sell only high quality product that meets market standards in packaging and appearance. Organic producers will need to seek out certified processors and handlers for their product if it is required by law in the state in which they are producing or selling to.

Some suggestions put forward by wholesale companies for producers include:

- Have enough product to make the delivery or pick-up worthwhile;
- Be knowledgeable of quality and packaging standards, and be able to meet the standards;
- Have adequate cooling and post-harvest handling methods that provide for optimum shelf-life of the product.

Packing Sheds

Packers either pack the grower's product or packs and sells the product. The packing shed will then charge a fee for packing plus take a percentage or charge a per box fee. Packing sheds are used primarily for tree fruits.

Distributors

Wholesale distributors buy large volumes of product from the farmer and resell it to a buyer. It is rare that a distributor will buy from a grower whose quality of produce is unknown, unless they have a high demand product that is in low supply.

Brokers

Brokers find a buyer for your produce, arrange for delivery, charge the buyer and pay the farmer. There are several different types of brokerage/sale arrangements and each situation is likely to different. As with wholesale distributors, it is rare that a broker will sell for a producer whose product is unknown to the broker and the development of a relationship between broker and producer is essential.

Cooperatives

In order to meet the large volume needs of a wholesale market, smaller scale farmers who produce a similar product will often form a cooperative to meet these needs. Cooperatives can operate as storer, packer, grader, and broker for their growers products. Cooperatives can also act as purchasing bodies, obtaining products such as packaging or production materials at lower prices than a single grower.

Processing Arrangements

There are a wide variety of processing arrangements. Usually the grower delivers the product to the processor. From the processor, the product is either sent to a co-packaging facility or it is sold by a broker. Typically a broker/processor will contract a grower for their entire crop for the duration of the season and will give advice on growing techniques.

Special thanks to Diane Dempster, Organic Produce Buyer - Charlie's Produce, Seattle, WA, for her informative contributions to this section.

Text written and prepared by:
Leslie Zenz, Sustainable Agriculture Coordinator, WSDA
Nancy Taylor, former Organic Program Specialist, WSDA

State Organic Laws

Quick Reference Guide

State	Contact	Address	Phone # E-mail & Fax	State Law	Certification Program	Livestock Standards	Processing/ Handling Standards	Materials List
Idaho	Margaret Misner	IDA Div. of Ag Inspection PO Box 790 Boise, ID 83701-0790	(208) 332-8661 mmisner@ agri.state.id.us Fax: (208) 334-2170	Yes	Yes	No	Yes	Yes
Montana	Stan Strom	Dept. of Public Health & Human Service Cogswell Bldg., 1400 Broadway Helena, MT 59620	(406) 444-2408 Fax: (406) 444-4135	Yes	No	Yes	No	No
Oregon	Jim Black	ODA, Food Safety Div. 635 Capital St. NE Salem, OR 97310	(503) 986-4720 Http//arcweb.sos.state.or.us/oarsos.html Fax (503) 986-4729	Yes	No	Yes	Yes	Yes
Utah	Ed Bianco	UDA, 350 N. Redwood Rd. S.L.C., UT 84116	(801) 538-7180 Fax (801) 538-7189	No	No	No	No	No
Washington	Miles McEvoy	WSDA Food Safety & Animal Health PO Box 42560, Olympia, WA 98504	(360) 902-1877 organic@agr.wa.gov Fax: (360) 902-2087	Yes	Yes	Yes	Yes	Yes
Wyoming	Chuck Higgens	WDA, 2219 Carey Ave., Cheyenne, WY 82001	(307) 777-6587 Fax: (307) 777-6593	No	No	No	No	No

Organic Certification Agencies

Quick Reference Guide

Certification Agency	Contact	Address	Phone # E-mail & Fax	Certifying in These Western States:	Organic Standards Cover the Following: *	Comments
Washington State Dept. of Agriculture	Miles McEvoy	Food Safety & Animal Health PO Box 42560, Olympia, WA 98504	(360) 902-1877 mmcevoy@agr.wa.gov Fax: (360) 902-2087	WA	C, L, P/H, T mushroom, greenhouse, wildplants	Only certifies groups within WA
Idaho Dept. of Agriculture	Jim Boatman	Div. of Ag Inspection PO Box 790 Boise, ID 83701-0790	(208) 332-8661 jboatman@agri.state.id.us Fax: (208) 334-2170	ID	C, P/H, T	Only certifies groups within ID
Organic Certification Assn of Montana	Tarn Reams	OCAM P.O. Box 7417 Missoula, MT 59807	(406) 549-9346 ocam@montana.com	MT – cert. for in-state sales only. (chapt. of OCIA)	See OCIA standards below	
Oregon Tilth	Yvonne Frost	1860 Hawthorne NE, Suite 200 Salem, OR 98303	(503) 378-0690 organic@tilth.org Fax: (503)378-0809	OR, UT, WA, MT, UT, WY & internat'l	C, L, P/H & T apiary, mushroom, wildplants	
Northern Utah Organic Growers	Martha Franks	P.O. Box 247, 2108 W. Main Trementon, UT 84337	(435) 257-0233	UT-(chapt. of OCIA)	See OCIA standards below	
Organic Crop Improvement Association	Jodi Snyder	OCIA, International 1001 Y St., Suite B Lincoln, NE 68508	(402) 477-2323 Fax: (402) 477-4325	MT, OR,,WA, & Internat'l	C,L, P/H & T apiary, mushroom, maple, wildplants, sprouts, sea veg.,& greenhouse	
Quality Assurance International	Griffith McLellan or Howe Ross	QAI 12526 High Bluff Dr., Ste.300 San Diego, CA 92130	(619) 792-3531 Fax: (619) 792-8665	ID, OR, UT, WA, WY, MT & Internat'l	C, & P/H apiary, mushroom, & maple,	
Farm Verified Organic	Annie Kirschenman	FVO Rural Route 1, Box 40A Medina, ND 58467	(701) 486-3578 farmvo@daktel.com Fax: (701) 486-3580	MT, OR, WA, & Internat'l	C, L, P/H, & T wildplants, maple, bananas, cacao, coffee, coconut, fish, apiary	
Calif. Certified Organic Farmers	Richard Taylor	CCOF 1115 Mission Street Santa Cruz, CA 95060	(760) 728-9664	nat'l Processor cert. & poss. Target State grower cert.	C, L, P/H, & T greenhouse, mushroom	Special procedures exist for certifying producers outside CA

***Productions systems included certifier standards: crops(C), livestock (L), processing & handling (P/H), and/or transitional (T). Specialty standards are listed in full. Please contact specific agency for information on certification procedures in a specific state.**

Resource Section

Table of Contents

This *Resource Section* has been developed to provide the reader with direction in finding more in-depth information about organic and sustainable agriculture. The organizations and support businesses have been provided for your convenience and we have done our best to find as many resources within the target states as possible. *Listing of these groups does not serve as an endorsement of their products or services*. Please be aware that many other organizations, working groups, and businesses exist to serve the organic and sustainable agriculture community and have not been listed here due to oversight and we extend apologies for any unintentional omissions.

Agricultural Organizations

Alternative Energy Resource Organization (AERO), 25 S. Ewing, Helena, MT 59047. (406) 443-7272, e-mail: aero@desktop.org. Non-profit, grassroots citizens' organization that promotes vital rural communities and conservation of soil, water, and other natural resources. AERO was formed in 1974.

Alternative Farming Systems Information Center (AFSIC) and Sustainable Agriculture Network(SAN), National Agriculture Library, USDA, ARS 10301, Baltimore Ave., Rm 304, Beltsville, MD 20705-2351.(301) 504-6559, e-mail: afsic@nal.usda.gov, & san@nal.usda.gov. Organic production and research publications, current information sources customized and reference service.

Appropriate Technology Transfer for Rural Areas (ATTRA) P.O. Box 3657, Fayetteville, AR 72702. (800) 346-9140, e-mail: askattra@ncatfyv.uark.edu. Information support organizations: consultations, publications, educational programs on all aspects of organic production.

Biodynamic Association, P.O. Box 550, Kimberton, PA 19442. (800) 516-7797. Non-profit organization that promotes practices and principles of organic biodynamic agriculture; offering publications, advisory services, training, supplies and research funding.

Center for Agroecology & Sustainable Food Systems, 1156 High Street, Santa Cruz, CA 95064. (831) 459-4140, Jim Leap or Ann Lindsey. A research and education group working toward the development of sustainable agricultural systems.

Center for Holistic Resource Management, 800 Rio Grande Blvd. NW, Rm. 12, Albuquerque, NM 87104 (505) 242-9272. Non-profit organization sponsoring workshops and courses throughout the US on farm profitability, biological control grazing management, and long-range planning.

The Center for Rural Affairs, P.O. Box 405, Walthill, NE 68067. (402) 846-5428, e-mail: hn1721@handsnet.org. Non-profit organization providing regulation and policies information on social, economic and environmental issues affecting rural America.

Center for Science in the Public Interest (CSPI), 1501-16th St. NW, Washington DC 20036. (202) 332-9110. Non-profit consumer and health advocacy organization serving as the lead organization for Americans for Safe Food.

Committee for Sustainable Agriculture, 406 Main Street # 313, Watsonville, CA 95076. (831) 763-2111. Lynn Young. A non-profit tax deductible 501(c)(3) educational organization incorporated in 1984; provides information and sponsors events on ecological farming-sustainable agriculture-organic farming and food safety to farmers-retailers-and consumers.

Community Alliance with Family Farmers, PO Box 363, Davis, CA 95617, (916) 756-8518. e-mail: caff@caff.org; www.caff.org, Ernest Phinney. Non-profit membership organization that is building a movement of rural and urban people who promote family-scale sustainable agriculture; uses advocacy and education to achieve its goals.

Consumers United for Food Safety (CUFFS), P.O. Box 22928, Seattle, WA 98122, (206) 747-2659. A consumer advocacy organization focusing on food safety and quality issues, including food irradiation and pesticides in food.

Cortesia Sanctuary & Center for Natural Gardening, 84540 McBeth Road, Eugene, OR 97405. (541) 343-9544, Tricia Clark-McDowell or Dr. Forrest McDowell. A 22-acre nature sanctuary and educational publishing center offering a variety of classes in natural gardening- herbalism and holistic nutrition.

Farmer Cooperative Genome Project, FCGP, Oregon Tilth Research and Education, Maple Dr., Junction City, OR 97448, JJ Haapala, (541) 998-3069, jhaap@tilth.org. The FCGP is a three year project to assemble a farmer owned seed cooperative. Participants in the effort will learn how to work with the National Plant Germplasm System and other seed resources, learn how to characterize varieties, grow true seeds, and develop varieties for preservation and sale.

Farming Alternatives Program, Warren Hall - Cornell University, Ithaca, NY 14853, (607) 255-9832. Dedicated to promoting a sustainable food and agriculture system which supports farm-families and their communities.

Henry A. Wallace Institute for Alternative Agriculture, 9200 Edmonston Road Ste. 117, Greenbelt, MD 20770-1551. (301) 441-8777, Dr. I. Garth Youngberg. Non-profit tax exempt research and education organization established to encourage and facilitate the adoption of low-cost resource conserving environmentally sound and economically viable farming systems; provides a national information clearinghouse; serves as a voice for agricultural sustainability in Washington and develops and implements policy research and educational outreach programs; holds special symposia and workshops.

Idaho Organic Producer's Association, 2260 East 4300 North, Filer, ID 83328. (208) 366-2555. Nathan Jones. Representing Idaho organic farmers and handlers; sponsors agricultural conferences to educate update and encourage organic/sustainable growing practices.

Kerr Center for Sustainable Agriculture, PO Box 588, Poteau, OK 74953. (918) 647-9123, e-mail: 6030351@mcimail.com. Non-profit 501(c)(3) organization striving to find ways of sustaining our world rather than exhausting natural resources; provides leadership and technical assistance.

The Land Institute, 2440 East Water Well Rd, Salina, KS 67401, (913) 823-5376. 275 acre research site devoted to sustainable prairie agriculture and stewardship offering internships.

Leopold Center for Sustainable Agriculture, 209 Curtiss Hall-Iowa State University, Ames, IA 50011-1050, (515) 294-3711, e-mail: leocenter@iastate.edu, Dennis R. Keeney. Provides grants-research-and education regarding sustainable agriculture.

Michael Fields Agricultural Institute, W2493 County Rd. ES, East Troy, WI 53120, (414) 642-3303, Fax (414) 642-4028, e-mail mfai@mfai.org. Non-profit education and research institute whose mission is to enhance the fertility of the soil, the quality of food, the health of animals, and the strength of the human spirit by revitalizing the culture of agriculture.

Multinational Exchange for Sustainable Agriculture, 5337 College Ave Ste. 508, Oakland, CA 94618, (510) 654-8858, e-mail: mesa@hooked.net, Lauren E. Augusta. Non-profit organization dedicated to the advancement of sustainable agriculture throughout the world; matches young farmers from abroad with host farmers in the US for a six or twelve month training experience.

National Coalition Against the Misuse of Pesticides, 701 E Street SE Ste. 200, Washington , DC, 20003-2831, (202) 543-5450, e-mail: ncamp@igc.apc.org, Sarah Sullivan. Non-profit membership organization of groups and individuals formed in 1981; serves as a national network committed to pesticide safety and the adoption of alternative pest management strategies which reduce or eliminate dependence on toxic chemicals.

National Organic Program Staff- US Department of Agriculture, USDA/AMS/TMD, Rm 2510, S-bldg., P.O. Box 96456, Washington, DC 20090-6456, (202) 720-8331. Information and publications regarding NOSB proposed standards recommendations and OFPA, materials lists, certification agencies and state contacts, and mailing lists.

New Farms, HC69 Box 62, Rociaa, NM 87742. (505) 425-5457, Alison Hobbs. Non-profit sustainable agriculture center specializing in training-education-research and demonstration.

Northern Plains Sustainable Agriculture (NPSAS), Rural Route 1, Box 73, Windsor, ND 58424 (701) 763-6287. Non-profit educational society for farmers to share information and develop organic and sustainable systems.

Northern Utah Organic Growers, PO Box 247, 2108 W. Main, Trementon, UT 84337, (435) 257-3976, Fax (435) 257-0233, Martha Franks. Certification agency certifiying growers/processors/handlers in UT as a chapter of OCIA. Also, a resource for production information, etc.

Northwest Coalition for Alternatives to Pesticides, PO Box 1393, Eugene, OR 97440, (503) 344-6923,e-mail: info@pesticide.org. Non-profit membership organization which has promoted the use of alternatives to pesticides since 1977; seeking reduction in pesticide use through community organizing-policy reform and education; NCAP is a five state coalition which includes Oregon-Washington-Idaho-Montana- and Northern California.

Oregon Tilth, 11535 SW Durham Rd., St. C-1, Tigard, OR 97224. (503) 620-2829, Yvonne Frost. Non-profit certification, educational and research organization, which supports and promotes organic and sustainable agriculture in the Pacific Northwest.

Organically Grown Cooperative, 1 South East Alder, Portland, OR 97214. (503) 232-0674. Farmer owned organic marketing cooperative representing local Oregon Farmers.

Organic Farmers Information & Education Foundation, 8364 S SR 39, Clayton, IN, 46118, (317) 539-4317, e-mail: cvof@iquest.net, Cissy Bowman. Non-profit educational arm of the Organic Farmers Marketing Association.

Organic Farming Research Foundation, P.O. Box 440, 303 Potrero Street Ste. 29-202, Santa Cruz, CA 95060, (831) 426-6606, e-mail: research@ofrf.org, Bob Scowcroft or Erica Walz. Non-profit tax exempt public foundation; our mission is to sponsor research related to organic farming; to disseminate research results to organic farmers and growers interested in adopting organic production systems and to educate the public and decision-makers about organic farming issues; provides funding for projects throughout North America.

Organic Materials Review Institute (OMRI), Kathleen Downey, P.O. 1158, Eugene, OR 97440-3758. (541) 343-7600, e-mail: omri@efn.org. Non-profit, professionally managed review of brand name materials used in production and processing of organic foods.

Organic Trade Association, P.O. Box 1078, 50 Miles Street, Greenfield, MA 01302. (413) 774-7511, e-mail: ota@igc.apc.org, Katherine T. DiMatteo. Membership-based organization including growers-retailers-manufacterers-certifiers-distributors-brokers-consultants and no-profits; encourages global sustainability through promoting growth of diverse organic trade.

Palouse-Clearwater Environmental Institute, PO BOX 8596, Moscow, ID 83843. (208) 882-1444, e-mail: pcei@moscow.com, Colette DePhelps. Non-profit organization dedicated to preserving out natural resources and improving economic and social conditions in our rural areas.

Pesticide Action Network North America Regional Center, 116 New Montgomery Ste. 810, San Francisco, CA, 94105, (415) 541-9140, e-mail: panna@panna.org;www.panna.org/panna, Monica Moore or Ellen Hickey, One of five regional coordination points throughout the world for Pesticide Action Network (PAN) international - a coalition of over 400 independent citizen organizations working for pesticide reform in over 60 countries; maintains an international pesticide information clearinghouse and publications

Provender Alliance, 500 Kourt Drive, Eugene, OR 97404. (541) 688-4493. Non-profit trade organization providing networking and education to natural foods and related companies doing business in the Northwest.

Rural Advancement Foundation International, PO Box 4672, Chapel Hill, NC 27514, (919) 929-7099, e-mail: HN1778@handsnet.org, J. Michael Sligh. Dedicated to the preservation of family farms; conservation of agricultural biodiversity; socially responsible use of new technology; safe food and sustainable agricultural systems.

Seattle Tilth Association, Michael Abbate, 4649 Sunnyside Avenue North Rm.1, Seattle, WA 98103, (206) 633-0451,e-mail: farmhand@seanet.com. The urban chapter of Washington Tilth focusing on gardening and ecological food production.

Seed Savers Exchange, 3076 North Winn Road, Decorah, IA 52101, (319) 382-5990, Kent Wheal. Non-profit tax-exempt grassroots organization of gardeners interested in preserving old time and heritage fruit vegetable varieties.

Sustainable Agriculture Research & Education Program (SAREP) , University of California 250 Hunt Hall, Davis, CA 95616-8716, (916) 752-7556, sarep@ucdavis.edu;www.sarep.usdavis.edu, William C. Liebhardt or Jill S. Auburn. SAREP's responsibilities are to fund scientific research for sustainable agricultural practices and public policies; distribute information to farmers; advise farmers and the public and coordinate the establishment of long-term research sites.

WSU-Center for Sustaining Agriculture & Natural Resources, Washington State University, 403 Hulbert Hall, Pullman, WA 99164-6240. (509) 335-0183, FAX: (509) 335-6751. Mission: The center shall provide state-wide leadership in research, extension, and resident instruction programs to sustain agriculture and natural resources.

Washington Sustainable Food & Farming Network, P.O. Box 6054, Bellingham, WA 98227-6054. A network of sustainable agricultural growers, organizations, university faculty, state agencies, retailers, and other stakeholders working to promote sustainable agriculture in Washington state.

Washington Tilth(Washington Tilth Producers), P.O. Box 85056, Seattle, WA 98145. (800) 731-1143. Non-profit volunteer organization of farmers focusing on sustainable and organic agriculture. Publishers of Washington Tilth Organic Directory.

Washington Toxic Coalition, Washington Toxics Coalition, 4516 University Way NE, Seattle, WA 98105, (206) 632-1545, e-mail: eshareder@watocixs.org. Non-profit citizens advocacy organization promoting groundwater protection, education and research to reduce toxics.

Western Sustainable Agricultural Working Group (SAWG), 3040 Belvidere Ave. SW, Seattle, WA 98126-2223,(206) 935-8738, FAX: (206) 935-1639, web: www.ecobio.com/wsawg/ . An association of 36 grassroots and affiliated sustainable agricultural organizations in WA, OR, ID, CO, MT, AZ, NV, NM, UT & in W. Canada, BC, AB, SK.

Agricultural Support Businesses

A-1 Unique Insect Control, 5504 Sperry Drive, Citrus Heights, CA 95621. (916) 961-7945, Jeanne Houston. Supplier of beneficial insects.

Ag Engineering & Development Co. Inc, PO Box 2814, Tri Cities, WA 99302. (509) 582-8900, Fax: 509 582-5282, Lamar Reeder. Manufacturer of farm equipment, primarily Dammer Diker™, a tillage implement that eliminates soil and erosion and water run-off.

Agrimar Corporation, PO Box 1419, Flowery Branch, GA 30542, (800) 638-6673, Fax: (509) 923-2747, E-mail: pirwin@nwi.net, Website: www.goemar.com, Phil Irwin. A marine biotechnology research institute that derives bioactive substances from sea plants for use in agriculture.

Beneficial Insectary, 14751 Oak Run Road, Oak Run, CA 96069. (916) 472-3523, Jill Peck. Natural enemy adhesives; technical support.

Biocontrol Ltd., 16010 NE 36th Ave, Richfield, WA 98642. (509) 664-7052 or (509) 961-3024, E-mail: gthayer@crcwnet.com, Glenn Thayer. Developers and suppliers of insect sex pheromone systems.

Bio-Oregon, Inc., 1935 NW Warrenton Dr., PO Box 429, Warrenton, OR 97146, (800) 962-2001, Fax: (503) 861-3701, E-mail: biooreg@pacifer.com, Walter Kost. Manufacturer of natural and organic fish based fertilizers.

Bio Soil Tech., 2260 E. 4300 N., Filer, ID 83328. (208) 326-4114. Organic soil amendments, and bio-products.

BioWorks, Inc, 122 N. Genesee St., Geneva, NY 14456. (800) 877-9443 ext. 318, Fax: (315) 781-1793, E-mail: lpullano@epix.net, Website: www.bioworksbiocontrol.com, Lisa Pullano. Bioworks, Inc. is a supplier to the agriculture industry of biological control products and biotechnologies that enhance plant health, plant productivity, and consumer and worker safety.

Bozeman Bio-Tech Inc., 1612 Gold Avenue, Bozeman, MT 59772. (406) 587-5891, Eric E. Vinje. Beneficial insects; pheromone traps; organic seeds and fertilizers; least-toxic pesticides; weed and plant disease controls; pet care products

California Liquid Fish Fertilizer, LLC, PO Box 949, Gonzalez, CA. (877) 675-8600 or (831) 675-8600, E-mail: peter@biolizer.com, Website: www.biolizer.com, Peter Townsley, Manufacturer and wholesaler of organic fertilizers.

Cascadia Landscape Design, Jude Hobbs, 1161 Lincoln St., Eugene, OR 97401. Phone: (541) 342-1160. Fax: (541) 342-7202. E-mail: hobbsj@efn.org. Permaculture designer focusing on farm plans, efficient productivity and a functional approach toward integrating plants, animals, water, structures and people.

Catalyst Product Group, 26201 W. Baseline Road, Buckeye, AZ 85236. (602) 814-3816, Mark Turner. Manufacturer and distributor of granular and liquid organic fertilizers; soil amendments and biological controls.

Cedar Grove Composting, Inc, 54 South Dawson St., Seattle, WA. (206) 768-3208, Fax: (206) 764-1234, E-mail: suzannel@nwwi.com, Website: www.cedar-grove.com, Suzanne Leger.

Cenex, 655 Sage Bay Dr., Moses Lake, WA 98837. (509) 989-2169, Bob Thompson. Full service row crop and tree fruit crop protection business.

Concentrates Inc., 801 Southeast Division Place, Portland, OR 97202. (800) 388-4870, William B. Sparks or Criss Dizick. Natural fertilizers amendments and conditioners; Meals (fish kelp blood bone cottonseed and canola); glacial rock dust; diatomaceous earth; rock phosphate; Jersey greensand; K-mag; perlite; vermiculite; liquid fish; chicken manure; bat guano; peat moss

Down to Earth, 532 Olive St. Eugene, OR 97401. Phone: (541) 342-6820. Supplier of naturally occurring soil amendments in the Pacific Northwest. They also carry tools and natural pest control products.

D. Stutzman Farms, PO Box 307, Canby, OR 97013, Jill Purtzer. Sup'r Green chicken manure fertilizer: a ground 100% organic composted mixture of sawdust and chicken manure

Earth Minerals Corporation, PO Box 550, Santa Clara, CA, 95052, (408) 984-4045, Rick Castello, remineralizing the earth; healthy soil promotion

Ecogen Inc, 3205 NW 113th Circle, Vancouver, WA 98685. (360) 546-1635, Fax: (360) 546-1636, E-mail: camino@portland.quik.com, Website: www.ecogeninc.com, Randall King. Ecogen is a basic producer of biopesticides for organic production, products include; AQ 10 - biofungicide for powdery mildew control, Aspire - yeast antagonist for decay control in post harvest fruit production, Bee Scent - pollination enhancement pheromone, Cruiser - Hb nematode for soft bodied soil insects, Condor WP - Bt for lepidopteran pests.

Eco-Nutrients Inc., PO Box 1068, Crescent City, CA 95531. (707) 464-5038, Ed Baker. Products from the ocean for organic fertilizers.

Engelhard Corp., 101 Wood Ave, Iselin, NJ 08830. (732) 205-7140, Fax (732) 321-1598 E-mail: john.mosko@englehard.com, Website: www.engelhard.com, John Mosko. Engelhard corporation offers Surround™ Crop Protectant, based on HPS™ Particle Film Technology, for insect and mite control/suppression and sun burn/heat stress reduction.

Fire & Water Weed Control Systems, 5025 North Syracuse, Portland, OR 97203, (503) 252-6044, Thom Hokanson. A unique weed control system that uses heat and steam to blanch and burn unwanted vegetation.

Genesis Agri-products, PO Box 10512, Yakima, WA. (509) 452-0302, Fax: (509) 249-2884, E-mail: doug@genesisag.com, Doug Anyan. Supplier of leaf feeds and surfactants to wholesalers and dealers.

Global Recycling & Research, Inc., 1000 Hilton Avenue, Bellingham, WA 98225. (888) 676-7844 or (360) 676-7844, Fax: (360) 676-8692, E-mail: cathie@kellygreen.net or info@kelliegreen.net, Website: www.kellygreen.net, Cathleen Kunz. A manufacturer of a certified organic fish emulsion fertilizer called KellyGreen.

G S Long Co., Inc., P.O. Box 9783, Yakima, WA 98909, (509) 575-8382, Doug Adams

G S Long, 2117 Old Town Rd., Union Gap, WA 98903. (800) 338-5664, E-mail: aaron@gslong.com, Website: www.gslong.com, Aaron Avila. Agricultural chemicals and fertilizers dealer.

Greenfire Inc., 347 Nord Avenue Ste. 1, Chico, CA 95926. (916) 895-8301, Jeanne Shelsky. Mail order organic nutrients; beneficial insects, plant extract insecticides.

Griffin Industries, 4221 Alexandria Pike, Coldspring, KY 41076. (800) 252-4727, Fax: (606)572-2574, E-mail: bdeckert@griffinind.com, Website www.naturesafe.com, Vic Garcia. A natural and organic fertilizer company.

Griffin L.L.C., PO Box 1847, Valdosta, GA 31603-1847. (800) 242-8635, Fax: (800) 446-8655, E-mail: jennifer.saracen@griffinllc.com, Website: www.griffinllc.com, Jennifer Saracen. Manufacturer of agricultural chemicals.

Hardesty Organic Turf and Garden Supply, 1259 El Camino Real Ste. 252, Menlo Park, CA 94025. (415) 325-5959, Robert Hardesty. CCOF certified fertilizers; organic weed & pest control.

Harmony Farm Supply & Nursery, 3244 Highway 116 # J, Sebastopol, CA 95472. (707) 823-9125, Kate Burroughs. Organic fertilizers; ecological pest controls.

Hynite Corp., 4301 E. Depot Rd., Oak Creek, WI 53154. (414) 762-1068, Fax: (414) 762-6778, E-mail: hynite@aol.com, Bruce Krantz. Produce HYNITE hydrolyzed leather meal, a natural organic fertilizer (12-0-0) in protein form.

Integrated Fertility Management, 333-B Ohme Gardens Rd., Wenachee, WA 98801. (509) 662-3179, (800) 332-3179, Phil Unterschuetz and Mariah Cornwoman. Regional supplier and consultant for farmers and gardeners; Specializes in organic farming procedures and products; technical support, soil testing, field monitoring.

J & G Agrow-Tek, 3341-F Fitzgerald Road, Rancho Cordova, CA 95742. (916) 635-0514, Lou Bock. organic and LISA fertilizers and soil amendments; garlic oil insect repellent.

Jerico Products Inc., 100 East D Street, Petaluma, CA 94952. (707) 762-7251, Mike Lind. Calcium supplier for livestock and growers.

Keg River Chemical Corp, 10350 21st St., Edmonton, Alberta, Canada, T6P 1W4. (888) 512-2121, Samantha Zemlak. Producer and marketer of sulfur fertilizer.

Live Earth Products Inc., PO Box 76, Emery, UT 84522. Dave Taylor or Trudy Lund, Mining and manufacturing of high quality humate products

Lee Kender Inc. Commercial Way, Oroville, CA 95965. (916) 534-7603, Chris Stegall. Kelp-based organic bio-catalytic systems.

M & R Durango Inc., 6565 Highway 172, Ignacio, CO 81137. (970) 259-3521, Gene Merrill. Beneficial insects and organisms; consultants and biocontrol of pest insects; specializing in insect parasitic nematodes and Nosema locustae spore (a grasshopper control agent.)

Martin Marietta Technologies, Corp, 4770 Duke Dr., Ste 200, Mason, OH 45040. (513) 701-1140, Fax (513) 701-1149, Email: steve.petrie@martinmarietta.com, Website: www.martinmarietta.com, Steve Petrie. Manufacturer of Eco-min Natural fertilizer and SC27 Soil Inoculant.

Nature's Intent, 186 Holmes Rd., Tonasket, WA 98855. (509) 223-3555. Fax: (509) 223-3551. E-mail: pci@nvinet.com, Website: www.pirl.com, Steve Drexler. Soil amendments for agriculture, lawn, and garden.

North Pacific Trading, PO Box 3915, Portland, OR 97208. (800)461-3477, Darren MacFarlane. Wholesale distributor of products for use in sustainable agriculture.

Northwest Ag Products (also called**,** B&B NW AG, NW AG Products, NAP Chemical, and Phytochem**)** PO Box 3453, Pasco, WA 99302. (509) 547-8234, E-mail: alan@nap-chem.com, Website: www.nap-chem.com**,** Alan Wicks. Wholesale manufacturer of micronutrient fertilizers, soil amendments, adjuvants, and drip irrigation line cleaners.

NW Wholesale, PO Box 1649, Wenatchee, WA 98807-1649. (509) 662-2141, Fax: (509) 663-4540, E-mail: nwwinc@nwi.net, Al Thompson. Sells agricultural supplies to the tree fruit industry.

Organic Ag Advisors, PO Box 1622, Colfax, CA 95713. (916) 637-5990, Amigo Cantisano. Research and consulting service working with growers of all sizes in all crops specializing in technical assistance for organic and transitional growers using ecological and economical practices.

Organic Agriculture Consultants, Lynn Coody, 3460 McMillen St., Eugene, OR 97405. (541) 343-6795, e-mail: 76305.3545@compuserve.com. Consulting services: farm systems planning, soil fertility, crop monitoring, pest control, research assistance and regulatory/policy analysis and development.

Pacific Calcium, 186 Holmes Rd., Tonasket, WA 98855. (509) 223-3555, Fax: (509) 223-3551, E-mail: pci@nvinet.com, Website: www.pirl.com, Steve Drexler. Soil amendments for agriculture, lawn, and garden.

Peaceful Valley Farm Supply, 110 Spring Hill Drive, Grass Valley, CA 95945. (916) 272-4769. Organic seeds; natural fertilizers and pest controls; beneficial insects; row covers; soil tests; weed controls; fall bulbs; tools and equipment.

Peninsula Organics, 25 Johnson Rd., Aberdeen, WA 98520. (360) 532-9279, E-mail: penorganics@olynet.com, Al Smith. Natural organic fish fertilizer, custom blending, mail order, consulting, wholesale to retailers, free technical support for products we sell.

PhytoChem, PO Box 3453, Pasco, WA 99302. (509) 545-6414, E-mail: alan@nap-chem.com, Website: www.nap-chem.com, Alan Wicks. Wholesale manufacturer of micronutrient fertilizers, soil amendments, adjuvants, and drip irrigation line cleaners.

Rocky Mountain Bio-Products Inc., PO Box 608, Edwards, CO 81637. (970)926-1025, Johanna Jensen. Distributor of Biosol Organic Fertilizer.

RSA MicroTech, 101 Elliot Ave W, Ste. 110, Seattle, WA 98119. (509) 285-4801 Fax: (509) 285-4902, Website: www.rsamicrotech.com, Doug Hinkins. Micronutrient and specialty fertilizer manufacturer.

Sharan Fertilizers, PO Box 126, Helm, CA 93627. (209)866-3003, Robert Wilson. Organic Fertilizers.

Soda Springs Phosphate Inc., 720 East Industrial Park, Soda Springs, ID 83276. (800)47-4220, John Hatfield or Lynn Moore. Chelate-complex and granulate rock phosphate.

Sustainable Farm Supply & California Organic Fertilizers Inc., 2641 South Maple Avenue, Fresno, CA 93725. (209)443-5690, Timothy Stemwedel. Organic fertilizers and pesticides

T& J Enterprises, 2328 W. Providence Ave., Spokane, WA 99205. (509) 327-7670, Fax: (509) 326-4707, E-mail: thomas@tandjenterprises.com, Website: www.tandjenterprises.com, Thomas Giannou. Distributor of Bio-Vam, a mycorrhizal root and soil inoculant that significantly increases the health of plants.

Tanio Technology and Technique, S. 12102 Andrus Rd, Cheney, WA 99004. (509) 747-5471, Fax: (509) 747-8122, E-mail: tainio@tainio.com, Website: www.tainio.com, Marc Tainio. An alternative fertilizer company that provides full service farming needs for organic and conventional growers.

Terra Firma Products Inc., 2899 Agoura Road Ste 142, Westlake Village, CA 91361. (818)865-0974, John Storojev or Mike Bogdanoff. Natural growing media.

Thermo Trilogy Corp., 9145 Guilford Road, Suite 175, Columbia, MD 21046-1883. (301) 483-3812 or Customer Service (800) 250-502, Fax: (301) 604-7030, E-mail: jmessina@thermotrilogy.com, Jim Messina. Thermo Trilogy Corporation is a leading manufacturer of biopesticides including Bacillus thuringiensis, Azadirachtin, and Neem Oil.

Walt's Organic Fertilizer Co., Inc., PO Box 31580, Seattle, WA 98103-1580. (206) 783 6685 Fax: (206) 297-9126 E-mail: worganic@connectexpress.com, Website: www.waltsorganic.com, Walt or Shirley Jane Benecki. Wholesale manufacturer and distributor of organic soil amendments.

Wetbridge Ag Products, 1150 Joshua Way, Vista, CA 92083. (800)876-2767. Specialty fertilizers and soil amendments; animal feed additives.

Wilbur-Ellis Co., PO Box 5225, Portland, OR 97208. (503) 227-2518, Steve Goffena or Pete Schoonveld. Distributor of organic fertilizers and animal feeds.

Wilbur-Ellis (Wenatchee, WA), PO Box 710, Wenatchee, WA 98807. (509) 663-8753, Fax: (509) 663-5192, E-mail flick@crcwnet.com, Website: www.wilburellis.com, Dan Flick. Supplier of agricultural products, including organic, conventional, mating disruption, fertilizers, and pesticides.

Wilbur-Ellis (Yakima, WA), 7 East Washington Ave, Yakima, WA 98903. (509) 248-6171 Fax: (509) 457-6613, E-mail: twagner@wecon.com, Website: www.wilburellis.com, Greg Pickel. Supplier of agricultural products, including organic, conventional, mating disruption, fertilizers, and pesticides.

World Wide Web Sites

Agriculture Resource and Environmental Indicators (AREI)
http://www.econ.ag.gov/Briefing/arei/arei.htm
AREI updates: Organic vegetable and fruit growers surveys.

Alternative Farming Systems Information Center
http://www.nal.usda.gov/afsic/
Publications, NAL document delivery information, biocontrol and alternative farming method patents, searchable database.

Appropriate Technology Transfer for Rural Areas (ATTRA) **http://www.attra.org**
Information packets and publications and organic educational programs.

Biological Control Home Page / Cornell University
http://www.nysaes.cornell.edu/ent/biocontrol
Biocontrol agents guide, parasitoids, predators, pathogens, weed feeders, related biological control links.

Biological Control Virtual Information Center **http://ipmwww.ncsu.edu/biocontrol/biocontrol.html**
Links to information on biological control organizations, databases and web sites around the world.

Canadian Organic Growers Publications **http://www.gks.com/cog/**
Publications, general information, related sites.

Cascadian Farm **http://www.cfarm.com**
Commercial site that includes Health food store D-base and National Organic Standards update section.

Center for Sustaining Agriculture and Natural Resources **http://csanr.wsu.edu/**
Publications, research specialists and other resource information.

Economic Research Service
http://usda.mannlib.cornell.edu/reports/erssor/specialty/vgs-bb/1997
1994 organic food & fiber analysis of certified producers, organic foods marketing reports.

The Food Alliance **http://www.thefoodalliance.org**
Non-profit organization working to increase the awareness of the link between environmentally friendly farming practices and protection of Northwest natural resources, crop specific sustainable standards and marketing label.

Food and Agriculture Organization (FAO) **http://www.fao.org/**
Publications, workshops, seminars, searchable database, World Agricultural Information Center.

Fruits and Vegetables Market Prices **http://www.todaymarket.com**
Worldwide agricultural prices information. Daily market reports, related resources.

HOT Agricultural and Farming Links **http://www.rural.org/Farmers_Guide/Agriculture/Hot_Site.htm**
Links to economic, government, commodity, extension, farm market reports and related sites.

Idaho Farm and Ranch Resource Center **http://www.oneplan.state.id.us/**
BMP's, organic farming, legislation, weather, related links.

IFOAM / International Federation of Organic Agriculture Movements http://ecoweb.dk/ifoam
Conferences, standards, accreditation program, publications.

Integrated Pest Management Program / Washington State University http://coopext.cahe.wsu.edu/~ipm/
Articles, publications, meetings, related links.

National Agricultural Library http://www.nal.usda.gov/
General information, online public catalog and journal article citation database, AgNIC: the Agriculture Network Information Center Webserver, related links.

Not Just Cows http://www.snymor.edu/~drewwe/njc/
Libraries, gophers, comprehensive list of related links, databases, internet and bitnet.

Organic Farmers Market Association (OFMA) http://www.iquest.net/ofma
Organic standards, Organic Foods Production Act, legislation, market reports, resources.

Organic Farming Research Foundation http://www.organicfood.com/Errata/ofrf1995.htm
National organic farm survey and organic research reports.

Organic Trade Association http://www.ota.com
Publications, news, events, directory of organic producers, certifiers, brokers, packers, etc.

Organic Trading and Information Center http://www.organicfood.com/
Question/answer forum, who's who directory, information library, legislative resources, directory, events.

Pesticide Action Network North America (PANNA) http://www.igc.apc.org/panna/
Searchable PESTIS database, publications, pesticide information, job announcements, links.

Sustainable Agriculture Network (SAN) http://www.ces.ncsu.edu/san/
USDA's SAREP: sustainable agriculture directory of expertise, reports, publications, and discussion groups.

University of California Sustainable Research and Education Program (UC SAREP)
http://www.sarep.ucdavis.edu/
Publications (online and other), conferences, grants, database, news resources, related links.

USDA- Farmers' Markets Database http://ams.usda.gov/farmersmarkets/map.htm
Website containing contact information for farmers' markets across the US, listed by state.

Yahoo's Agriculture Listing http://www.yahoo.com/Science/Agriculture/
Extensive list of WWW links related to all aspects of agriculture.

Washington State Department of Agriculture- Organic Food Program
http://agr.wa.govFoodAnimal/Organic/default.htm
Information regarding WA organic certification and the Organic Resource Manual; a guide to organic certification, crop and livestock production, marketing, and extensive resources.

Farmers' Markets in the Target States

USDA- Farmers' Markets Database
http://ams.usda.gov/farmersmarkets/map.htm
Website containing contact information for farmers' markets across the US, listed by state.

Idaho
21 markets: statewide
Contact: Kim Murphy, Idaho State Dept. of Agriculture, Division of Market & Support Services, P.O. Box 790, Boise, ID 83701, (208) 332-8538, e-mail: kmurphy@agri.state.id.us

Montana
7 markets: Billings, Bozeman, Great Falls, Helena, Havre, Kalispell, Missula
Contact: Paul Nordstrom, Montana State Dept. of Agriculture, 303 N Roberts, P.O.Box 200201, Helena, MT 59620, (406) 444-2402, e-mail: pnordstrom@state.mt.us

Oregon
36 markets: statewide
Contact: Cathi McLain, Oregon Dept. of Agriculture, 1207 NW Naito Pkwy., Suite 104, Portland, OR 97209-2832, (503) 872-6600, e-mail: cmclain@ada.state.or.us

Utah
3 markets: Salt Lake City, Spanish Fork, Sandy
Contact: Randy Parker, Utah Dept. of Agriculture, P.O. Box 146500, S.L.C., UT 84114, (801) 538-7108, e-mail agmain.rparker@email.state.ut.us
or
Eric Shedlarski (Downtown Farmers' Market), Downtown Allience, #9 Exchange Place, suite 401, Salt Lake City, UT, 84111, (801) 359-5118

Wyoming
6 markets: Buffalo, Casper, Cheyenne, Powell, Riverton, Worland
Contact: Jason Fearneyhough, Wyoming Business Council, 214 W. 15th St., Cheyenne, WY 82002, (307) 777-2860, e-mail jfearn@missc.state.wy.us

Washington
67 markets: statewide
Contact: Zach Lyons, Washington State Farmers Market Association, P.O.Box 30727, Seattle, WA 98103-0727, (206) 706-5198, e-mail zach@wafarmersmarkets.com

Marketing Support Businesses & Organizations

agAccess Information Service, 424 2nd Street Ste B, Davis, CA 95616. (916)756-0778, Jack Kenward. Information; market studies; business plans; consultations.

Avatar Marketing Inc., 2320 Paseo del Prado Ste. B-303, Las Vegas, NV 89102. (702)227-0102, Kimberly Driggs. National sales and marketing management; launching new companies and/or products and related industries; promotional campaigns; trade show and demo assistance; selection and management of natural broker and distribution network.

Creative Resources, 3755 Birchwood #48, Boulder, CO 80304. (303)442-2532, Elaine Lipson. Writing; communications; marketing (including cause-related); publicity and design for organic and natural foods and fabrics.

The Food Alliance, Deborah Kane, 1829 NE Alberta, Suite 5, Portland, OR 97211. (503) 493-1066, http://www.thefoodalliance.org. Non-profit organization working to increase the awareness of the link between environmentally friendly farming practices and protection of Norhtwest natural resources, crop specific sustainable standards and marketing lable.

The Hartman Group, 10422 SE 14th Street, Bellevue, WA 98004. (260) 451-9094, e-mail hartma29@mail.idt.net. Combines strong business consulting skills with a singular focus on the environment to integrate client's environmental challenges with their competative needs and strategic priorities.

Martin Roth & Co, 2410 Santa Clara Street, Richmond, CA 94804. (510) 527-7066, Kristin Brun. Product concept formulation marketing and sales.

Natural Business Communications, PO Box 7370, Boulder, CO 80306. (303) 442-8983, Steve Hoffman or Frank Lampe. Providing executive level business financial and investment news and information for the natural and organic products industry.

New Hope Communications/Natural Products Expo, 1301 Spruce Street, Boulder, CO 80302. (303) 939-8440, Mary Cote. The largest natural organic products industry exposition and conference in the United States.

Organic Farmers Marketing Association, 8364 S SR 39, Clayton, IN 46118. Cissy Bowman. Represents a new cooperative approach towards enhancing organic supply and marketing; created in response to organic farmers' desire for implementation of more efficient marketing concepts to keep pace with large scale organic food and fiber production and distribution.

Organic Suppliers Advisory Council, PO Box 1078, Greenfield, MA 01302. (413) 774-7511, Suzanne Vaupel. Working sector group of the Organic Trade Association bringing together marketers and producers of organic growing supplies to promote organic production and protect organic integrity; dedicated to increasing the organic input market by lowering regulatory barriers and creating joint marketing efforts.

Pacific Organics, Inc., Rob Gould, 255 Richmond St. SE Salem, OR 97301-6714. Phone: (503) 361-2302. E-mail: info@pacorganics.com. Consulting firm that works with companies to turn their organic by-products into assets. They specialize in the development and marketing of natural fertilizers and soil amendments derived from organic by-products.

Puget Sound Fresh Steve Evans, 14819 SE 62nd Ct., Bellevue, WA 98006. (206) 296-7824. Marketing label reflecting the importance of locally produced food in western Washigton, developed by King County Agriculture Commission.

Starr Track, 1508 Henderson Street, Eureka, CA 95501. (707) 442-9178, Sara Starr. Marketing services and strategic planning.

T & T Industries Inc., 1835 Dawns Way, Fullerton, CA 92831, (714) 284-6555, Tim Slaven. Labels for produce for wet environments; bar codes; recipes.

Washington State Farmers' Markets Association, P.O.Box 30727, Seattle, WA 98103-0727. (206) 706-5198, web: www.wafarmersmarkets.com, Non-profit organization of member farmers' markets across the state. Provides support and educational opportunities to market managers and producers.

Other Resource Guides

National Organic Directory
Contains periodicals, newsletters and reports, books, directories, catalogs, farmers, wholesalers, manufacturers/processors, retailers, farm suppliers, support businesses, certification groups, resource groups, and various articles pertaining to organic issues.
Published by: Community Alliance with Family Farmers, 1999 (6th edition)
For a copy: CAFF P.O. Box 363, Davis, CA 95617, (530) 756-8518 ext. 17, e-mail nod@caff.org $47.95

A Sustainable Agriculture Resource Guide for Oregon and Washington
Agricultural organizations, periodicals, books, university resources, databases and computer software, video tapes and other media, educational opportunities, and information sources in topic categories
Published by: Oregon State University, 1993
For a copy: Publications orders, Agricultural Communications, Oregon State University, Administrative Services A422, Corvallis, OR 97331-2119 $9.00

Small Farm Resource Guide
State-by-state listing of agencies and private organizations geared toward providing resources and information for small farms
Published by: USDA - CSREES, 1998 (1st edition)
For a copy: The Small Farm Program, USDA- CSREES, Plant and Animal Systems, Stop 2220, 1400 Independence Ave., SW, Washington, DC 20250-2220, (202) 401-4385, e-mail sfp@reeusda.gov Free

A Guide to USDA and Other Federal Resources for Sustainable Agriculture and Forestry Enterprises
Includes organizations offering resources in the following topics: research, information and new technology; financing businesses and new enterprises; management assistance, marketing assistance, conservation and resource management; community development; and other resource groups.
Published by: USDA agencies in collaboration with The Michael Fields Agricultural Institute, 1998
For a copy: (see *Agricultural Organizations* - ATTRA, The Michael Fields Ag Inst., and SARE) Free

Sustainable Agriculture Directory of Expertise
Profiles of more than 700 organizations and individuals who can help you meet your farming stewardship and profitability goals.
Published by: Sustainable Agriculture Network (SAN) 1996 (3rd edition)
For a copy: Sustainable Agriculture publications, Hills Building, University of Vermont, Burlington, VT 05405-0082, (802) 656-0471 $18.95

Publication Reference Section

The following entries are books, publications, journal articles, and reference documents that focus on specific topics in organic and sustainable agriculture. They are listed by topic and, due to the systemic nature of sustainable agricultural practices, some entries may appear in several topic areas.

♣ Entries in this section that are marked with a "club" are recommended by the editors.

There are several main sources for the technical publications that have been selected for this manual. In order to facilitate access to these, the source information has been provided below. Each of these sources has a wealth of publications on technical information for organic and sustainable farming practices. This resource manual has only selected a limited few. We encourage the reader to explore each of these sources further if more information on a particular topic is needed.

Please refer to the *Agricultural Organizations* section for more information on other valuable resources for technical information publications.

Appropriate Technology Transfer for Rural America (ATTRA)
These entries will be denoted as: ATTRA#. These publications can be found by contacting ATTRA at: P.O. Box 3657, Fayetteville, AR 72702, (800) 346-9140, e-mail: askattra@ncatfyv.uark.edu or on the internet at http://www.attra.org

Alternative Farming Systems Information Center (AFSIC)
Entries will be denoted as: DNAL#. These resources can be found through the AFSIC at the National Agriculture Library, USDA, ARS 10301, Baltimore Ave., Rm 304, Beltsville, MD 20705-2351, (301) 504-6559, e-mail: afsic@nal.usda.gov or can be found on the internet at http://warp.nal.usda.gov/afsic

USDA-Sustainable Agriculture Research and Education (SARE) program and Sustainable Agriculture Network (SAN)
Sources will be denoted as: SARE#. This number represents the project and results from research that received SARE funding. Many of these are available on the internet at www.wsare.usu.edu or can be aquired by calling: (435) 797-2257. SAN is the communications and outreach arm of the SARE program and can be found on the internet at http://www.sare.org

Michael Fields Agricultural Institute
W2493 County Rd. ES, East Troy, WI 53120, (414) 642-3303

Rodale Books: 1-800-527-8200, 33 E. Minor St., Emmaus, PA 18098 (Free catalog available)

Biodynamic Farming

Agriculture
Steiner, Rudolf
SOURCE: Michael Fields Agricultural Institute

Biodynamic Culture of Fruit Trees
Audio Productions. Committee for Sustainable Agriculture.
Ecological Farmer Conference (1990 : Asilomar, Calif.)
SOURCE: Colfax, CA : CSA ; [Seattle, WA : Distributed by] Audio Productions, [1990] 1 sound cassette (ca. 90 min.).
CATALOG #: DNAL Audiocassette-no.158

Organization, Economic Performance and Labor Requirements on Biodynamic Farms
Koepf, Herbert
SOURCE: Michael Fields Agricultural Institute (reprinted from Star and Furrow, Summer 1986 no. 66)

Research in Biodynamic Agriculture: Methods and Results
Koepf, Herbert
SOURCE: Michael Fields Agricultural Institute

The Biodynamic Farm
Koepf, Herbert
SOURCE: Michael Fields Agricultural Institute

Business & Economics

The Economic Implications of Organic Farming
Cacek, Terry and Linda L. Langner
SOURCE: American Journal of Alternative Agriculture, 1(1):pp.25-29, 1986.

An Economic Model of a Farm's Transition to Organic Agriculture
Dabbert, S.; Madden, P
SOURCE: Global perspectives on agroecology and sustainable agricultural systems: proceedings of the sixth international scientific conference of the International Federation of Organic Agriculture Movements. Santa Cruz, CA : Agroecology Program, University of California, c1988.. p. 45-54a.
CATALOG #: DNAL S605.5.I45-1986

Production Costs and Relative Profitability of Organically Grown Vegetables
Dhillon, Pritam S. and Barbara Palladino
SOURCE: Journal of the Northeastern Agricultural Economics Council, v.10(1):pp.11-16,
CATALOG #: DNAL HD1773.A2N6

The Comparative Economics of Alternative Agricultural Production Systems: An Annotated Bibliography
Fox, Glenn, et al.
SOURCE: Department of Agricultural Economics and Business, Working paper series, WP 91-02, University of Guelph, Guelph, Ontario

The Socioeconomics of Sustainable Agriculture : An Annotated Bibliography
Goreham, Gary A.; Watt, David L.; Jacobsen, Roy M.
Special Technical Publication: Garland reference library of the humanities ; vol. 1332.
SOURCE: New York : Garland, 1992. xix, 334 p.
CATALOG #: DNAL Z5074.E3G69-1992

The Economics of Organic Farming : An International Perspective
Lampkin, Nicolas, and Susanne Padel
SOURCE: Wallingford : CAB International, c1994. xvi, 468 p. : ill.
CATALOG #: DNAL S605.5.E26--1994

Profitable Organic Farming
Newton, Jon.
SOURCE: Oxford [England] ; Cambridge, Mass., USA : Blackwell Science, 1995. xviii, 142 p. : ill.
CATALOG #: DNAL S605.5.N48--1995

Vetch Cuts Costs
Shirley, C.
SOURCE: New-farm. Emmaus, Pa. : Rodale Institute. Nov/Dec 1992. v. 14 (7) p. 26-30.
CATALOG #: DNAL S1.N32

Organic Agriculture: A Growth Industry in Idaho
Flocchini, J.
SOURCE: J-pestic-reform. Eugene, OR : Northwest Coalition for Alternatives to Pesticides. Spring 1993. v. 13 (1) p. 8-9.
CATALOG #: DNAL SB950.2.A1J58

How to Determine Your Cost of Production
Takele, E.
SOURCE: 1990, Davis: University of California Division of Agriculture and Natural Resources Pub. No. ANRP011 (componet of *Farm Mananagement, Family Farm Series*)

Conventional/Organic Production Comparison

The Environmental Effects of Conventional and Organic/Biological Farming Systems
Arden-Clarke, C.
SPECIAL TECHNICAL PUB.: Research report (Political Ecology Research Group) ; RR-16.
SOURCE: Oxford, England : Political Ecology Research Group Pest management, [1988] 109 p.
CATALOG #: DNAL S589.7.A7

Comparing Conventional and Alternative (Organic) Potato Systems
Cummings, Tom, R.E. Thornton, and Tom Schotzko
SOURCE: Spudman, August, 1994, pp.26-27

Soil Microbial Populations and Activities Under Conventional and Organic Management
Fraser, D.G., et al.
SOURCE: Journal of Environmental Quality, 1988, p.585-590

Nitrogen Turnover on Organic and Conventional Mixed Farms
Halberg, N.; Kristensen, E.S.; Kristensen, I.S.
SOURCE: J-agric-environ-ethics. Guelph, Ont. : University of Guelph, 1991-. 1995. v. 8 (1) p. 30-51.
CATALOG #: DNAL BJ52.5.J68

Comparison of Nitrogen and Phosphorous Flows on an Organic and Chemical Farm
Patten, A.G.W.
SOURCE: M.S. thesis, Washington State Univ., Pullman, WA, 1982

Organic and Conventional Peach Production and Economics
Rader, John S. et al.
SOURCE: Biological Agriculture and Horticulture, v.2(3):pp.215-222, 1985
CATALOG #: DNAL S605.5.B5

Comparison of Soil Properties as Influenced by Organic and Conventional Farming Systems
Reganold, J.P.
SOURCE: Am-J-Alternative-Agric. Greenbelt, Md. : Institute for Alternative Agriculture. Fall 1988. v. 3 (4) p. 144-155. ill., maps.
CATALOG #: DNAL S605.5.A43

Long-Term Effects of Organic and Conventional Farming on Soil Erosion
Reganold, J.P.; Elliott, L.F.; Unger, Y.L.
SOURCE: Nature. Neptune, N.J. : Macmillan Journals. Nov 26/Dec 2, 1987. v. 330 (6146) p. 370-372.
CATALOG #: DNAL 472-N21

The Comparative Productivity of Organic Agriculture
Stanhill, G.
SOURCE: Agric-Ecosyst-Environ. Amsterdam : Elsevier. Jan 1990. v. 30 (1/2) p. 1-26.
CATALOG #: DNAL S601.A34

An Analysis of Costs and Returns in Conventional and Organic Vegetable Production
Teichert, Kurt
SOURCE: New Alchemy Institute, Research Report no. 2, East Falmouth, MA

Conventional, Low-Input and Organic Farming Systems Compared
Temple, S.R.; Somascorchard, O.A.; Kirk, M.; Friedman, D.
SOURCE: Calif-agric. Oakland, Calif. : Division of Agriculture and Natural Resources, University of California. Sept/Oct 1994. v. 48 (5) p. 14-19.
CATALOG #: DNAL 100-C12Cag

Comparison of Organic and Conventional Agriculture : A Literature Review
McKinney, T. R.
SOURCE: Snowmass, Colo. : Rocky Mountain Institute, [1987] 13 leaves
CATALOG #: DNAL S605.5.M34

Barriers to Low-Input Agriculture Adoption: A Case Study of Richmond County, Virginia
Diebel, P.L.; Taylor, D.B.; Batie, S.S.
SOURCE: Am-J-altern-agric. Greenbelt, MD : Henry A. Wallace Institute for Alternative Agriculture. 1993. v. 8 (3) p. 120-127.
CATALOG #: DNAL S605.5.A43

Field Crops

Intercropping Autumn-Sown Field Beans and Wheat: Effects on Weeds Under Organic Conditions
Bulson, H.A.J.; Snaydon, R.W.; Stopes, C.E.
SOURCE: Monograph-Br-Crop-Prot-Counc. Thornton : The Council. 1990. (45) p. 55-62.
CATALOG #: DNAL SB599.B73

Evaluation of Sulphur with LI700 Against Foliar Diseases of Winter Wheat Grown to Organic Standards
Culshaw, F.A
SOURCE: Tests-Agrochem-Cult. London : Association of Applied Biologists. May 1992. (13) p. 30-31.
CATALOG #: DNAL S587.T47

The Effects of Variety Blends and Seedrates on Disease and Weed Incidence in Wheat Grown in Organic Systems
Dover, P.A.; East, J.
SOURCE: Monograph-Br-Crop-Prot-Counc. Thornton : The Council. 1990. (45) p. 239-243.
CATALOG #: DNAL SB599.B73

N, P and K on Organic Farms: Herbage and Cereal Production, Purchases and Sales
Fowler, S.M.; Watson, C.A.; Wilman, D.
SOURCE: Journal Agric-Sci. Cambridge : Cambridge University Press. June 1993. v. 120 (pt.3) p. 353-360.
CATALOG #: DNAL 10-J822

An Agronomic and Economic Comparison of Conventional and a Low-Input Cropping System in the Palouse
Goldstein, Walter and Young, Douglas L.
SOURCE: Michael Fields Agricultural Institute (reprint from American Journal of Alternative Agriculture, spring 1987, v.2, no.2)

Establishment, Diseases and Yield of Organically-Grown Wheats
Guest, S.J.; Samuel, A.M.; Davies, W.P.
SOURCE: Monograph-Br-Crop-Prot-Counc. Thornton : The Council. 1990. (45) p. 223-226.
CATALOG #: DNAL SB599.B73

Influence of Undersown Clovers on Weeds and on the Yield of Winter Wheat in Organic Farming
Hartl, W.
SOURCE: Agric-Ecosyst-Environ. Amsterdam : Elsevier. Nov 1989. v. 27 (1/4) p. 389-396.
CATALOG #: DNAL S601.A34

Organic Field Crop Production : a Review of the Economic Literature
Knoblauch, Wayne A.; Brown, Rebecca.; Braster, Martin.
New York State College of Agriculture and Life Sciences. Dept. of Agricultural Economics.
SPECIAL TECHNICAL PUB.: A.E. res. ; 90-10.
SOURCE: Ithaca, N.Y.: Dept. of Agricultural Economics, Cornell University, Agricultural Experiment Station, New York State College of the State University, Cornell University, [1990] 19 p.
CATALOG #: DNAL 281.9-C81A-no.90-10

Cereals and Crop Rotation: a Report of Walter Goldstein's Research
Linder, M.
SOURCE: Bio-dynamics. Wyoming, R.I. : Bio-Dynamic Farming and Gardening Association. Winter 1986. (157) p. 40-43. ill.
CATALOG #: DNAL 56.8-B52

Organic Field Crop Handbook
Macey, Anne.; Kramer, Dee
Canadian Organic Growers
SOURCE: Ottawa, Ont. : Canadian Organic Growers Inc., c1992. iv, 192 p. : ill.
CATALOG #: DNAL S605.5.K722-1992

Crop Rotations and Manure Versus Agricultural Chemicals in Dryland Grain Production
Sahs, W.W.; Lesoing, G.
SOURCE: Journal ofSoil & Water Conservation, Ankeny, Iowa : Soil Conservation Society of America. Nov/Dec 1984. v. 40 (6) p. 511-516.
CATALOG #: DNAL 56.8-J822

Effect of Seed Rates and Within Crop Cultivations in Organic Winter Wheat
Samuel, A.M.; Guest, S.J.
SOURCE: Monograph-Br-Crop-Prot-Counc. Thornton : The Council. 1990. (45) p. 49-54.
CATALOG #: DNAL SB599.B73

Weed Studies in Organic and Conventional Cereals
Samuel, A.M.; Guest, S.J.
SOURCE: Monograph-Br-Crop-Prot-Counc. Thornton : The Council. 1990. (45) p. 183-186.
CATALOG #: DNAL SB599.B73

Yield, Grain Quality and Disease Incidence of Milling Wheat Varieties Grown Organically
Samuel, A.M.; Young, R.J.
SOURCE: Tests-Agrochem-Cult. London : Association of Applied Biologists. Apr 1989. (10) p. 172-173.
CATALOG #: DNAL S587.T47

Winter Rye Control for Weed Control in Soy Beans
SOURCE: SARE Project no. LNC 88-21

Converting to Organic Grain Crops
Sills, W.
SOURCE: Small Farm News. Davis, Calif. : U.C.D. Small Farm Center. May/June 1991. p. 6.
CATALOG #: DNAL HD1476.U52C27

The Growth, Yield and Quality of Winter Wheat and Winter Oats Grown Under an Organic Conversion Regime
Storey, T.; Hogan, R.; Humphreys, J.
SOURCE: Wellesbourne, Warwick : The Association of Applied Biologists. 1993. v. 36 p. 199-204.
CATALOG #: DNAL QH301.A76

The Effect of Season and Management on the Grain Yield and Breadmaking Quality of Organically Grown Wheat Cultivars
Thompson, A.J.; Gooding, M.J.; Davies, W.P.
SOURCE: Asp-appl-biol. Wellesbourne, Warwick : The Association of Applied Biologists. 1993. v. 36 p. 179-188.
CATALOG #: DNAL QH301.A76

General Organic Production

Going Organic
Garrett, J.H.
SOURCE: Chicago, Ill. : American Nurseryman Publishing Company. Oct 1, 1992. v. 176 (7) p. 70-72, 74-75.
CATALOG #: DNAL 80-AM371

♣The New Organic Grower
Coleman, Elliot
SOURCE: 1989 (1993 5th edition). Chelsea Green. Chelsea:Vermont
ISBN: 0-930031-22-9

The Socioeconomics of Sustainable Agriculture : An Annotated Bibliography
Goreham, Gary A.; Watt, David L.; Jacobsen, Roy M.
Special Technical Pub.: Garland reference library of the humanities ; vol. 1332.
SOURCE: New York : Garland, 1992. xix, 334 p.
CATALOG #: DNAL Z5074.E3G69-1992

♣Organic Farming
Lampkin, N
SOURCE: Farming Press Books, U.K., 1990, ISBN: 0-85236-191-2

Converting to Organic Farming
Lampkin, N.; Vogtmann, H.
Special Technical Pub.: Practical handbook series (Hamstead Marshall, England) ; 3.
SOURCE: Hamstead Marshall, Berkshire, Great Britain : Elm Farm Research Centre, 1986. 95 p. : ill.
CATALOG #: DNAL S605.5.C6

Organic Farming in North America
Miguel A. Altieri, with contributions by Richard B. Norgaard
SOURCE: Agroecology : the scientific basis of alternative agriculture / [et al.]. Boulder, Colo.: Westview Press, 1987. p. 107-114.
CATALOG #: DNAL S589.7.A47

Rotational Design and the Limits of Organic Systems: The Stockless Organic Farm
Millington, S.; Stopes, C.; Woodward, L.
SOURCE: Monograph-Br-Crop-Prot-Counc. Thornton : The Council. 1990. (45) p. 163-173.
CATALOG #: DNAL SB599.B73

Organic Farming in the United States: Principles and Perspecctives
Parr, J.F., R.I. Papendick and I.G. Youngberg
SOURCE: Agro-ecosystems v.8:pp.183-201

Report and Recommendations on Organic Farming
United States Department of Agriculture
SOURCE: USDA, Washington, D.C., 94 p., 1980

Permaculture : A Designers' Manual
Mollison, Bill.; Slay, Reny Mia.
SOURCE: Tyalgum, Australia : Tagari, c1988. xi, 576 p., [24] p. of plates : ill. (some col.), maps
CATALOG #: DNAL S605.5.M6

Growing Fruits and Vegetables Organically
Nick, Jean M. A. and Bradley, Fern Marshall (editors)

Rodale's All-New Encyclopedia of Organic Gardening
Rodale Press
SOURCE: Rodale Press. Emmaus: Penn. 1978 (1st edition). ISBN 0-87857-225-2

Livestock

Integrating Fish on an Organic Farm
Andow, David
SOURCE: SARE Project no. FNE 93-30

Marketing Natural or Organic Meat, Poultry and Eggs : Information Package
Appropriate Technology Transfer for Rural Areas (ATTRA).
SOURCE: Fayetteville, Ark. : Appropriate Technology Tranfer for Rural Areas, 1991. 1 v. (various pagings) : ill.
CATALOG #: DNAL S605.5.M37-1992

Technical and Economic Comparisons of Dairy Farms Using Conventional, Reduced Input and Organic Production Techniques
Bateman, K.
SOURCE: ATTRA #7002844

Organic Dairy Farming
Benson, Laura Lee, and Robert Zirkel for Kickapoo Organic Resource Network.
SOURCE: Gays Mills, WI : Orang-utan Press, 1995. 87 p. : ill.
CATALOG #: DNAL SF239.B46--1995

Veterinary Uses of Aloe Vera
Coats, Bill and Richard E. Holland
SOURCE: 1985. Out of print-available at Powell's Books: www.powells.com

Homeopathic Treatment of Small Animals
Day, Christopher
SOURCE: 1990. C.W. Daniel Company Limited. Out of print-available at Powell's Books: www.powells.com

Organic Animal Husbandry
Fritz, Sandy.; Andresen, Thomas
SOURCE: Sydney:Australia, Fritz & Associates, 1994. 62 p.
CATALOG #: DNAL S605.5.F75

Healing Animals with Herbs
Heinerman, John
SOURCE: 1977 (1983). BiWorld Publishers. Provo:UT. Out of print- available at Powell's Books: www.powells.com

Integrating Animals into a Production System
Koepf, H.H.
SOURCE: Sustainable agriculture & integrated farming systems : 1984 conference proceedings / edited by Thomas C. Edens, Cynthia Fridgen, Susan L. Battenfield. East Lansing, Mich. : Michigan State University Press, 1985. p. 34-42.
CATALOG #: DNAL S441.S8

♣Herbal Handbook for Farm and Stable
Levy, Juliette deBairaeli
SOURCE: 1976. Rodale Press: Emmaus, Penn.

Organic Beef Production
Neilson, D.R.; Peebles, K.; Scott, N.A.; Lowman, B.G.
SOURCE: Occas-Symp-Br-Grassl-Soc. Hurley, Berkshire : The Society. 1988. (22) p. 273-277.
CATALOG #: DNAL SB197.B7

The Krusenbaum Farm: A Case Study and Model in the Establishment of an Organic Dairy
Posner, J.L.; Hall, J.
SOURCE: Sustainable Agriculture Research and Education (SARE) or Agriculture in Concert with the Environment ACE research projects.1990. 62 p.
CATALOG #: DNAL S441.S855

Organic Poultry
Rawson, Julie for Natural Organic Farmers Association.
SOURCE: Barre, MA : Natural Organic Farmers Association, c1988. 1 videocassette (90 min.) : sd., col.
CATALOG #: DNAL Videocassette-no.614

Lean Pork, Low Overhead:
Pasturing Pigs Lets This Couple Capitalize on Quality
Shirley, C.
SOURCE: New-farm. Emmaus, Pa. : Rodale Institute. Nov/Dec 1993. v. 15 (7) p. 20-24, 58.
CATALOG #: DNAL S1.N32

Health Status of Dairy Herds Converting from Conventional to Organic Dairy Farming
Weller, R.F.; Cooper, A.
SOURCE: London : The British Veterinary Association. Aug 10, 1996. v. 139 (6) p. 141-142.
CATALOG #: DNAL 41.8-V641

The Use of Herbal Leys in Modern British Organic Farming Systems
Woodward, L.; Foster, L.
SOURCE: Global perspectives on agroecology and sust. agr. systems: proc. of the sixth intl. scientific confer. of the IFOAM. Santa Cruz, CA : Agroecology Program, University of California, 1988. p. 421-431.
CATALOG #: DNAL S605.5.I45-1986

Factors Affecting the Conversion of a Clover-Based Beef System to Organic Production
Younie, D.; Heath, S.B.; Halliday, G.J.
SOURCE: Occas-Symp-Br-Grassl-Soc. Hurley, Berkshire : The Society. 1988. (22) p. 105-111.
CATALOG #: DNAL SB197.B7

Marketing

Marketing that Serves the Soil
Bowman, G.
SOURCE: New-farm. Emmaus, Pa. : Rodale Institute. Nov/Dec 1992. v. 14 (7) p. 35-41.
CATALOG #: DNAL S1.N32

Consumer Demand for Food Safety-Oriented Marketing Labels:
Implications for Sustainable Agriculture
Cook, R.L.
SOURCE: Fremont, Calif. : California Weed Conference Proceedings. 1992. (44th) p. 115-127.
CATALOG #: DNAL 79.9-C122

Increasing Organic Agriculture at the Local Level :
A Manual for Consumers, Grocers, Farmers & Policy Makers
Hansen, Maren for Community Environmental Council. Santa Barbara County Safe Food Project.
SOURCE: Santa Barbara, County Calif. : Community Environmental Council, Inc., Gildea Resource Center, c1992. 98, xvi p. : ill.
CATALOG #: DNAL S605.5.H37-1992

A Survey of Organic Produce Purchases and Related Attitudes of Food Cooperative Shoppers
Goldman, B.J. and Clancy, K.L.
SOURCE: American Journal of Alternative Agriculture, 6(2):pp.89-96, 1991

Organic Foods: Consumer Attitudes and Use
Jollyu, D.A. et al.
SOURCE: Food technology 43(11):p.60, 1989

♣Sell What You Sow
Gibson, Eric
SOURCE: New World Publishing [1994], Auburn, CA
CATALOG #: LCCN:92-090951., ISBN 0-9632814-0-2

Farms of Tomorrow
Grogh, T. and S. McFadden
SOURCE: New World Publishing, Aubrun CA

From Kitchen to Market: Selling Your Gourmet Food Specialty
Hall, S.F.
SOURCE: New World Publishing, Auburn, CA

Agritourism in New York State:
Opportunities and challenges in farm based recreation and hospitality
Hilchey,D.
SOURCE: Ithica: Cornell University. (undated) 122p. bulletin

Community Supported Agriculture: Networks, Resource Lists, and Biblographies
DePhelps, C.
SOURCE: Pullman: Washington State University Cooperative Extension, 1996

Rebirth of the Small Family Farm: a Handbook for Starting a Sucessful Organic farm based on the community supported agriculture concept
Gregson, B. and Gregson, B.
SOURCE: Vashon Island: IMF Associates, 1996, PO Box 2542, Vashon Island, WA 98070

The Organic Organizer: A Publication for Studying New Organic Marketing Options
National Organic Marketing Cooperative Feasibility Study (1996)
SOURCE:Mt Judea: Ozark Small Farm Viability Project, Inc, PO Box 99, Mt Judea, AR 72655

Orchards & Viniculture

Organic Tree Fruit Production
Auvil, T.
SOURCE: Proc-Wash-State-Hortic-Assoc. Wenatchee, Wash. : The Association. 1989. (85th) p. 68.
CATALOG #: DNAL 81-W273

♣Organic Tree Friut Management
Edwards, Linda
SOURCE: 1998. COABC, Keremeos, BC, Canada. 240 pp.
ISBN: 0-931682-52-5

Organic Grapes
AUTHOR: Becker, Chris
SOURCE: SARE Project no. LNE 90-20

♣Cover Cropping in Vineyards
Ingels, C.R. Bugg, G. McGourty, L. Christenson (editors)
SOURCE: 1998. University of California DANR Publication 3338. Oakland:CA
ISBN: 1-879906-35-X

Alternatives for Controlling Peach Leaf Curl
Burkam, L.
SOURCE: Common-sense-pest-control-q. Berkeley, CA : Bio Integral Resource Center, c1984-. Spring 1992. v. 8 (2) p. 16.
CATALOG #: DNAL SB950.A1C62

Organic Experiences in Codling Moth Control
Caprile, J.
SOURCE: Calif-Grow. Carpinteria, Calif. : Rincon Information Management Corporation. Sept 1992. v. 16 (9) p. 31-32.
CATALOG #: DNAL SB379.A9A9

Postharvest Quality and Sensory Attributes of Organically and Conventionally Grown Apples
DeEll, J.R.; Prange, R.K.
SOURCE: *HortScience*. Alexandria, Va. : The American Society for Horticultural Science. Oct 1992. v. 27 (10) p. 1096-1099.
CATALOG #: DNAL SB1.H6

Organic Viticulture in West Germany
AUTHOR: Dabbert,-S.; Oberhofer,-J.
SOURCE: Am-J-Alternative-Agric. Greenbelt, Md. : Institute for Alternative Agriculture. 1990. v. 5 (3) p. 106-113.
CATALOG #: DNAL S605.5.A43

Postharvest Physiological Disorders, Diseases, and Mineral Concentrations of Organically and Conventionally Grown 'McIntosh' and 'Cortland' Apples
DeEll, Jennifer R. and R.K. Prange
SOURCE: Canadian Journal of Plant Science v.73(1):pp.223-230, 1993

Compost Pays Off in the Orchard
Farrell, M.
SOURCE: Biocycle. Emmaus, PA : JG Press, c1981-. Oct 1996. v. 37 (10) p. 40, 42.
CATALOG #: DNAL 57.8-C734

Organic Tree Fruit Production
Fuller, R.
SOURCE: Proc-Wash-State-Hortic-Assoc. Wenatchee, Wash. : The Association. 1989. (85th) p. 64, 66.
CATALOG #: DNAL 81-W273

Microbial Activities in Soil from Orchards Regularly Treated with Pesticides Compared to the Activity in Soils without Pesticides (organically cultivated)
Helweg, A.
SOURCE: Pedobiologia. Jena, E. Ger. : Gustav Fischer. 1988. v. 32 (5/6) p. 273-281.
CATALOG #: DNAL 56.8-P343

Organic Control of Fungal Diseases of Grapevines
Gadoury, D.M.
SOURCE: J-Am-Wine-Soc. Rochester, N.Y. : The Society. Fall 1995. v. 27 (3) p. 88-94.
CATALOG #: DNAL TP544.A4

Sample Costs to Produce Organic Wine Grapes in the North Coast With an Annually Sown Cover Crop.
Klonsky, Karen, Laura tourte, and Chuck Ingels.
SOURCE: University of California Cooperative Extension, Davis.
CATALOG #: DNAL HD1401.G532

Insect Pest and Natural Enemy Populations in Paired Organic and Conventional Apple Orchards in the Yakima Valley, Washington
Knight, A.
SOURCE: J-Entomol-Soc-BC. Vancouver : The Society. Dec 1994. v. 91 p. 27-36.
CATALOG #: DNAL 420-B77

Organic Apples Possible with Natural Insecticides, Disease Resistance
Kovach, J.
SOURCE: Agfocus-Publication, Middletown, N.Y. : Cornell Cooperative Ext.--Orange County Agriculture Program, Education Center. May 1991. p. 13-14.
CATALOG #: DNAL S544.3.N7A4

Comparative Effects of Margosan-O (neem extract) and Imidan on Plum Curculio and Apple Maggot
Prokopy, R.J.; Christie, M.; Bemis, J.
SOURCE: Fruit-notes. Amherst, Mass. : Cooperative Extension Service, College of Agriculture, University of Massachusetts, Amherst, 1968-. Spring 1993. v. 58 (2) p. 18-19.
CATALOG #: DNAL 275.29-M381Fr

Organic and Conventional Peach Production and Economics
Rader, John S. et al.
SOURCE: Biological Agriculture and Horticulture, v.2(3):pp.215-222, 1985
CATALOG #: DNAL S605.5.B5

Efficacy and economics of codling moth control in organic and conventional pome fruit production
Rader, John S., et al.
SOURCE: Biological Agriculture and Horticulture v.2(4):pp.315-321, 1985
CATALOG #: DNAL S605.5.B5

Organic Apples
Swezey, Sean
SOURCE: SARE Project no. AW 92-9

Granny Smith Conversions to Organic Show Early Success
Swezey, S.L.; Rider, J.; Werner, M.R.; Buchanan, M.; Allison, J.; Gliessman, S.R.
SOURCE: Calif-agric. Oakland, Calif. : Division of Agriculture and Natural Resources, University of California. Nov/Dec 1994. v. 48 (6) p. 36-44.
CATALOG #: DNAL 100-C12Cag

Mating Disruption for Controlling the Codling Moth in Organic Apple Production in Southwestern Ontario
Trimble, R.M.
SOURCE: Can entomol. Ottawa : Entomological Society of Canada, 1868-. July/Aug 1995. v. 127 (4) p. 493-505.
CATALOG #: DNAL 421-C16

Challenges in Organic Fruit Production
Van-Diepen, J.
SOURCE: Annu-Rep-Mich-State-Hortic-Soc. East Lansingrains, Mich. : The Society. 1989. (119) p. 51-54.
CATALOG #: DNAL 81-M58

Pest Management - General

Diversification Of Agricultural Landscapes:
A Vital Element For Pest Control In Sustainable Agriculture
Altieri, Miguel A.
SOURCE: Sustainable Agriculture & Integrated Farming Systems: 1984 Conference Proceedings / edited by Thomas C. Edens, Cynthia Fridgen, Susan L. Battenfield. East Lansing, MI: Michigan State University Press, 1985. p. 166-184.
CATALOG #: DNAL S441.S8

The Role of Host Plant Resistance to Pests in Organic and Low Input Agriculture
Ellis, P.R.
SOURCE: Monograph Br Crop Protection Councel. Thornton : The Council. 1990. (45) p. 93-102.
CATALOG #: DNAL SB599.B73

♣Guide to Crop Protection in Alberta: Part 2 Non-Chemical Control
SOURCE: 1988. Alberta Agriculture. Edmonton, AB, Canada. 134 pp.

Organic Corn Pest Control
Maravell, Nick
SOURCE: SARE Project no. FNE 93-12

Soil Nitrogen Management and Interaction with Crop Pests and Diseases in Organic Farming
Stockdale, E.A., McKinlay, R.G., and Rees, R.M.
SOURCE: Asp-appl-biol. Wellesbourne, Warwick : The Association of Applied Biologists. 1992. (30)
Catalog #: DNAL QH301.A76

♣Organic Plant Protection
Yepsen, Roger B. Jr. (editor)
SOURCE: Rodale Press, Inc., Emmaus: Pennslyvania, 1976

♣Common Sense Pest Control
Olkowski, W., S. Daar, and H. Olkowski
SOURCE: Newtown, Conneticut:The Tauton Press 1991

Rodale's Pest & Disease Problem Solver: A Chemical-Free Guide to Keeping Your Garden Healthy
Gilkeson, Linda, Pam Peirce, and Miranda Smith
SOURCE: 1996. Rodale Press. Eammus:Penn. ISBN: 087-596-7051

Alternative Control Measures for Pests of Vegetables
Decoteau, D.R.; Keinath, A.P.; Carner, G.
SOURCE: ATTRA #9158605

Productivity of Pesticides, Integrated Pest Management and Organic Farming
Hall, Darwin C.
SOURCE: Department of Economics Working Paper Series, no. 48, University of California, Riverside.

♣Puget Sound Pest Management Guidelines
Menzies, G. and B. Peterson
SOURCE: 1993. WSU Cooperative Extension-Whatcom County. Bellingham: WA. 131 pp.

1998 IPM Almanac
Gempler's
SOURCE: 1998. Gempler's. Beltsville: WI

Pest Management-Weeds

How to Control Weeds Organically
Lanini, W.T.
SOURCE: California Grower. Vista, Calif. : Rancher Publications. Jan 1987. v. 11 (1) p. 13-14.
CATALOG #: DNAL SB379.A9A9

Organic Control of Common Weeds
French, Jackie.
SOURCE: Melbourne : Aird Books, 1989. 123 p. : ill.
CATALOG #: DNAL SB611.5.F73

Weed Control with Winter Rye
Helm, J.L.; Zollinger, R.K.
SOURCE: NDSU-Ext-Serv-Publ-North-Dakota-State-Univ. Fargo, N.D.: The University. Nov 1991. (A-199,rev.) 2 p.
CATALOG #: DNAL S544.3.N9C46

Growing Plants without Herbicides : Chemical Free Control of Unwanted Plants
Morgan, Wendy C. with Victoria. Dept. of Agriculture and Rural Affairs.
SOURCE: Melbourne, Vic. : Schwartz & Wilkinson, c1990. 67 p. : ill.
CATALOG #: DNAL SB611.5.M6

Costs of Flame Cultivation
Nemming, A.
SOURCE: Acta-hortic. Wageningen : International Society for Horticultural Science. Aug 1994. (372) p. 205-212.
CATALOG #: DNAL 80-Ac82

Controlling Weeds without Chemicals
Regenerative Agriculture Asso.,
SOURCE: Emmaus, Pa. : Regenerative Agriculture Association, c1986. 38 p. : ill.
CATALOG #: DNAL SB611.C66

Weeds : Control without Poisons
Walters, Charles,
SOURCE: Kansas City, Mo. : Acres U.S.A., 1991. xvi, 320 p. : ill.
CATALOG #: DNAL SB611.5.W35

Geese for Weeds
Wurtz, Tricia
SOURCE: SARE Project no. LAW 91-1

Biocontrol of Weeds
Wyse, Don
SOURCE: SARE Project no. ANC 92-13

Weed Control in Organic Farming Systems
Patriquin, D.G.
SOURCE: Weed management in agroecosystems : ecological approaches / editors, Miguel A. Altieri, Matt Liebman. Boca Raton, Fla. : CRC Press, c1988. p. 303-317.
CATALOG #: DNAL SB611.5.W43

Pest Management-Insects

The Ecology of Insect Pest Control in Organic Farming Systems: Toward a General Theory
Altieri, M.A.
SOURCE: 1984 / H. Vogtmann, E. Boehncke, I. Fricke, eds. [Witzenhausen : Verlagsgruppe Witzenhausen], c1986. p. 405-420. CATALOG #: DNAL S605.5.I45-1984

Organic Control of Leafhoppers
Maravell, Nick
SOURCE: SARE Project no. LNE 91-5

Organic Control of Flea Beetles
Bonhag, Myra
SOURCE: SARE Project no. FNE 93-4

Western Entomologists For a More Rational Approach to Pest Management
Brunner, J.; Hoyt, S.
SOURCE: Resist-Pest-Manage. East Lansingrains, Mich.: Pesticide Research Center, Michigan State University. Feb 1991. v. 3 (1) p. 5-6.
CATALOG #: DNAL SB957.R47

♣**Pest Management at the Crossroads** (IPM)
Benbrock, Charles, et.al
SOURCE: 1996. Consumers Union. Yonkers:New York.
ISBN: 0-89043-900-1

Insect Damage Limits Yield, Profits of Organic Apples
Caprile, J.; Klonsky, K.; Mills, N.; McDougall, S.; Micke, W.; Van-Steenwyk, B.
SOURCE: Calif-agric. Oakland, Calif. : Division of Agriculture and Natural Resources, University of California. Nov/Dec 1994. v. 48 (6) p. 21-28.
CATALOG #: DNAL 100-C12Cag

Ecological Effects of Organic Agricultural Practices on Insect Populations
Culliney, T.W.; Pimentel, D.
SOURCE: Agric-Ecosyst-Environ. Amsterdam : Elsevier. Apr 1986. v. 15 (4) p. 253-266.
CATALOG #: DNAL S601.A34

Alternatives to Regular Insecticide Applications for Control of Lepidopterous Pests of Brassica
Endersby, N.M.; Morgan, W.C.; Stevension, B.C.; Waters, C.T.
SOURCE: Biol-Agric-Hort-Int-J. Oxon : A B Academic Publishers. 1992. v. 8 (3) p. 189-203.
CATALOG #: DNAL S605.5.B5

Beneficial Insects on Organic Farms --An Evaluation
Linker, H. M.
SOURCE: ATTRA #9170611

Alternate Management of Leafhopper Pests in Integrated Farming Systems: Demonstration of Biological and Cultural controls
Maravell, N.
SOURCE: Sustainable Agriculture Research and Education SARE or Agriculture in Concert with the Environment ACE research projects. [1988-. 1993. [26] 7 p.
CATALOG #: DNAL S441.S855

Effect of Traditional Insect-Repellent Plants on Insect Numbers in a Mixed Planting System
Matthews, D.L.; Michalak, P.S.; MacRae, R.J.
SOURCE: Environmentally sound agriculture : selected papers, 4th conference, International Federation of Organic Agriculture Movements, Cambridge, Mass., August 18-20, 1982 / edited by William Lockeretz. New York : Praeger, 1983. p. 117-127.
CATALOG #: DNAL S604.5.E58

The Derivation of Economic Thresholds for Insect Crop Pests, and Their Role in Crop Protection Decision-Making in Low Input and Organic Farming Systems
Parker, W.E.
SOURCE: Monograph-Br-Crop-Prot-Counc. Thornton : The Council. 1990. (45) p. 209-212.
CATALOG #: DNAL SB599.B73

Aphid Infestation of Fababeans on an Organic Farm in Relation to Weeds, Intercrops and Added Nitrogen
Patriquin, D.G.; Baines, D.; Lewis, J.; Macdougall, A.
SOURCE: Agric-Ecosyst-Environ. Amsterdam : Elsevier. July 1988. v. 20 (4) p. 279-288.
CATALOG #: DNAL S601.A34

Pest Management - Disease

Plant Disease Control
Bailey, J.E.
SOURCE: Agricultural Extension Service N. Carolina State University. Raleigh, N.C.: The Service Dec 1991. (331,rev.) p. 78-92.
CATALOG #: DNAL S544.3.N6N62

Evaluation of Sulphur with LI700 Against Foliar Diseases of Winter Wheat Grown to Organic Standards
Culshaw, F.A
SOURCE: Tests-Agrochem-Cult. London : Association of Applied Biologists. May 1992. (13) p. 30-31.
CATALOG #: DNAL S587.T47

Update on Using Composts and Watery Extract from Composts for Reducing or Suppressing the Incidence of Plant Diseases in Field and Garden Crops
Koepf, Herbert
SOURCE: Michael Fields Agricultural Institute

The Implication for Plant Diseases and Pests During the Conversion from Conventional to Biological Agriculture
Piorr, H.P., Hindorf, H.
SOURCE: The importance of biological agriculture in a world of diminishing resources : Proc. of the 5th IFOAM Int. Scientific Conference at the Univ of Kassel (Germany), Aug 27-30, 1984 / H. Vogtmann, E. Boehncke, I. Fricke, eds. [Witzenhausen : Verlagsgruppe Witzenhausen], c1986. p. 421-435. ill.
CATALOG #: DNAL S605.5.I45-1984

Row Crops

Growing Potatoes Organically
Amato, D.
SOURCE:*Small Farm Today*. Columbia, MO: Missouri Farm Publishing Inc., Feb 1993. v. 10 (1) p. 44-45
Catalog#: DNAL S1.M57

Alternative Control Measures for Pests of Vegetables
Decoteau, D.R.; Keinath, A.P.; Carner, G.
SOURCE: ATTRA #9158605

♣Growing Great Garlic : the Definitive Guide for Organic Gardeners and Small Farmers
Engeland, Ron L.
SOURCE: Okanogan, WA : Filaree Productions, 1991. xii, 213 p. : ill., maps
Catalog#: DNAL SB351.G3E53-1991

Cultural Practices and Sample Costs for Organic Vegetable Production on the Central Coast of California
Klonsky, K.; Tourte, L.; Chaney, D.; Livingston, P.; Smith, R.
SOURCE: Giannini Foundation Information Service. Davis, CA : Giannini Foundation of Agricultural Economics. 1994. (94-2) 87 p.
CATALOG #: DNAL HD1401.G532

Practical Constraints and Opportunities for Improving Crop Protection in Organic Vegetable Production
Peacock, L.
Monograph Br Crop Protection Councel. Thornton : The Council. 1990. (45) p. 157-162.
CATALOG #: DNAL SB599.B73

Organic tomato
Shennan, Carol
SOURCE: SARE Project no. LW 88-3

The Effects of Crop Combination and Row Arrangement in the Intercropping of Lettuce, Favabean and Pea on Weed Biomass and Diversity and on Crop Yields
Sharaiha, R. and Gliessman, S.
SOURCE: Biololgical Agriculture and Horticulture International Journal. Oxon : A B Academic Publishers. 1992. v. 9 (1) p. 1-13.
CATALOG #: DNAL S605.5.B5

Small Fruit

Organic Culture of Blackberries and Raspberries : Information Package
Appropriate Technology Transfer for Rural Areas (Organization)
SOURCE: [Fayetteville, Ark. : Appropriate Technology Transfer for rural Areas, 1991?] 1 v. (various pagings) : ill.
CATALOG #: DNAL SB386.B6O75-1991

Delicious, Profitable, and Certified Organic Raspberries: Washington Growers at Work
Brenner, L.
SOURCE: Journal of pesticide reform. Eugene, OR : Northwest Coalition for Alternatives to Pesticides. Spring 1993. v. 13 (1) p. 5-7.
CATALOG #: DNAL SB950.2.A1J58

Organic Strawberry & Blueberry Production
Committee for Sustainable Agriculture. Audio Productions. Ecological Farmer Conference (1990 : Asilomar, Calif.).
SOURCE: Colfax, CA : CSA ; [Seattle, WA : Distributed by] Audio Productions, [1990] 1 sound cassette (90 min.).
CATALOG #: DNAL Audiocassette-no.153

Cover Crops Replace Herbicides in Berries
Kendall, D.
SOURCE: New-Farm. Emmaus, Pa. : Regenerative Agriculture Association. Jan 1989. v. 11 (1) p. 53, 57. ill.
CATALOG #: DNAL S1.N32

Year-Round Pesticide-Free Strawberries Grow in Cornell Greenhouse
Segelken, R.
SOURCE: Agfocus Middletown, N.Y. : Cornell Cooperative Ext.-Orange County Agriculture Program, Education Center. Oct 1991. p. 5, 7.
CATALOG #: DNAL S544.3.N7A4

Soil Fertility Management

Sustainable Fertility Management : Information Package
Appropriate Technology Transfer for Rural Areas (ATTRA).
SOURCE: [Fayetteville, Ark. : Appropriate Technology Transfer for Rural Ares, 1991] 1 v. (various pagings) : ill.
CATALOG #: DNAL S494.5.S86-1991

Combining Legumes and Compost:
A Viable Alternative for Farmers in Conversion to Organic Agriculture
Astier, M.; Gersper, P.L.; Buchanan, M.
SOURCE: Compost-sci-util. Emmaus, PA : JG Press, 1993-. Winter 1994. v. 2 (1) p. 80-87.
CATALOG #: DNAL TD796.5.C58

Feed the Microbes
Bowman, G.
SOURCE: New-farm. Emmaus, Pa. : Rodale Institute. Nov/Dec 1992. v. 14 (7) p. 8-12.
CATALOG #: DNAL S1.N32

Manuring Strategies, Catch Crops and N-fixation
Fragstein, P.
SOURCE: Biol-agric-hortic. Oxon : A B Academic Publishers. 1995. v. 11 (1/4) p. 275-287.
CATALOG #: DNAL S605.5.B5

Organic Nitrogen Available
Gundy, L.G.
SOURCE: SARE Project no. LNC 88-6

Feather Meal: A Semi-Slow-Release Nitrogen Fertilizer for Organic Farming
Hadas, A.; Kautsky, L.
SOURCE: Fertil-res. Dordrecht : Kluwer Academic Publishers. 1994. v. 38 (2) p. 165-170.
CATALOG #: DNAL S631.F422

Guano as a Nitrogen Source for Fertigation in Organic Farming
Hadras, A.; Rosenberg, R.
SOURCE: Fert-Res-Int-J-Fert-Use-Technol. Dordrecht : Kluwer Academic Publishers. Feb 1992.
v. 31 (2) p. 209-214.
CATALOG #: DNAL S631.F422

Organic Waste and Residue Managment on Small Farms:
Crop Rotation, Tillage Methods, Soil Fertility
Hornick, S.B.
SOURCE: Misc. Publication USDA. Washington, D.C., The Department. July 1982. (1422) p. 267-268.
CATALOG #: DNAL 1-AG84M

Nutrient Management in Organic Farming Systems: The Case of Nitrogen
Kopke, U.
SOURCE: Biol-agric-hortic. Oxon : A B Academic Publishers. 1995. v. 11 (1/4) p. 15-29.
CATALOG #: DNAL S605.5.B5

Effects of Organic Manure on Nitrification in Arable Soils
Laanbrock, H.J.; Gerards, S.
SOURCE: Biol-Fertil-Soils. Berlin : Springer International. Oct 1991. v. 12 (2) p. 147-153.
CATALOG #: DNAL QH84.8.B46

The Soil : Assessment, Analysis and Utilization in Organic Agriculture
Lampkin, N.; Woodward, L.
Special Technical Publication: Practical Handbook Series
SOURCE: Hamstead Marshall, Berkshire, Great Britain : Elm Farm Research Centre, 1991. 52 p. : ill.
CATALOG #: DNAL S593.2.S59--1991

Manure Handling Alternatives Cut Costs
Logsdon, G.
SOURCE: Biocycle. Emmaus, PA : JG Press, c1981-. July 1993. v. 34 (7) p. 52-54.
CATALOG #: DNAL 57.8-C734

Importance of Nonsymbiotic Nitrogen-fixing Bacteria in Organic Farming Systems
Markus, P.; Kramer, J.
SOURCE: Azospirillum IV : genetics, physiology, ecology : proceedings of the fourth Bayreuth azospirillum workshop / edited by Walter Klingmuller. Berlin : Springer-Verlag, c1988. p. 197-204.
CATALOG #: DNAL QR82.A9A98

Utilization of Farmyard Manure and Composted Farmyard Manure: "A manuring strategy"
Ott, P.
SOURCE: The Importance of Biological Agriculture in a World of Diminishing Resources: proc of the 5th IFOAM Int. Scientific Conference at the Univ of Kassel (Germany), Aug 27-30, 1984. p. 61-73.
CATALOG #: DNAL S605.5.I45-1984

Cover Crops
SOURCE: SARE Project no. LNE 88-5

Utilizing the Nitrogen Content of Organic Manures on Farms: Problems and Practical Solutions
Smith, K.A.; Chambers, B.J.
SOURCE: Soil-use-manage. [Oxford, Oxdordshire] : Published by the British Society of Soil Science by Blackwell Scientific Publications, 1985-. Sept 1993. v. 9 (3) p. 105-112.
CATALOG #: DNAL S590.S68

Nitrogen Fixation in a Sustainable Agriculture
Sprent, J.I.
SOURCE: Biol-Agric-Hort. Berkhamsted : A B Academic Publishers. 1986. v. 3 (2/3) p. 153-165.
CATALOG #: DNAL S605.5.B5

Soil Nitrogen Management and Interaction with Crop Pests and Diseases in Organic Farming
Stockdale, E.A.; McKinlay, R.G.; Rees, R.M.
SOURCE: Wellesbourne, Warwick : The Association of Applied Biologists. 1992. (30) p. 387-392.
CATALOG #: DNAL QH301.A76

The Use of Different Kinds of Agricultural Organic Matter in Crop Production
Szalai, T.; Radics, L.; Birkas, M.
SOURCE: Ecol-Bull. Copenhagen K : Munksgaard International Booksellers and Publishers. 1988. v. 39 p. 57-58.
CATALOG #: DNAL QH540.S7

Undersown and Direct Sown Cover Crops for Nitrogen Retention in Organic Farming Systems
Watson, C.A.; Taylor, B.R.; Younie, D.
SOURCE: Wellesbourne, Warwick : The Association of Applied Biologists. 1992. (30) p. 327-330.
CATALOG #: DNAL QH301.A76

Improved Plant Health Through Applications of Composted Organic Material and Composts Extracts
Weltzien, H.C.; Budde, K.; Ketterer, N.; Samerski, C.; Stindt, A.
SOURCE: Agricultural alternatives and nutritional self-sufficiency for a sustainable agricultural system that respects man and his environment: proc of the IFOAM Seventh Int Scientific Conference, Ouagadougou, January 2-5, 1989. p. 377-379.
CATALOG #: DNAL S605.5.I45-1989

On-Farm Composting : A Method for Converting Manure into Soil-Building Humus While Saving Time, Money and Fuel
Land Stewardship Project (U.S.).
SOURCE: Lewiston, MN : Land Stewardship Project, 1991. 8 p. : ill.
CATALOG #: DNAL S661.O5

Options for Recycling Organics on Farmland
Edwards, J.H.; Walker, R.H.; Guertal, E.A.; Norton, L.D.; Eason, J.T.
SOURCE: Biocycle. Emmaus, PA : JG Press, c1981-. Nov 1994. v. 35 (11) p. 66-68.
CATALOG #: DNAL 57.8-C734

Start with the Soil
Gershuny, Grace
SOURCE: 1993. Rodale Press. Emmaus:PA

The Rodale Book of Composting
Gershuny, Grace and Martin, Deborah L. (editors)

Managing Cover Crops Profitably
SOURCE: Sustainable Agriculture Network (SAN)

Sustainable Agriculture & The Environment

The Environmental Effects of Conventional and Organic/Biological Farming Systems
Arden-Clarke, C.
SPECIAL TECHNICAL PUB.: Research report (Political Ecology Research Group) ; RR-16.
SOURCE: Oxford, England : Political Ecology Research Group Pest management, [1988] 109 p.
CATALOG #: DNAL S589.7.A7

Sorting Out the Environmental Benefits of Alternative Agriculture
Crosson, P.; Ostrov, J.E.
SOURCE: J-Soil-Water-Conserv. Ankeny, Iowa : Soil and Water Conservation Society of America. Jan/Feb 1990. v. 45 (1) p. 34-41. ill.
CATALOG #: DNAL 56.8-J822

Our Food, Our Environment
Douglis, C. 1995
SOURCE: 1995. Emmaus: Rodale Press, 33 East Minor St., Emmaus, PA 18098

Farming Practices for Ground Water Protection
Adams, E.B. 1992
SOURCE: 1992. Pullman: Washington State University Cooperative Extension Pb. No. EB1716